



LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA22 | Whittington to Handsacre

Survey reports (CH-004-022)

Cultural heritage

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Appendix CH-004-022

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1 Introduction

1.1 Structure of the cultural heritage appendices

1.1.1 The cultural heritage appendices for the Whittington to Handsacre CFA (CFA22) comprise:

- Appendix CH-001-022 – Baseline report;
- Appendix CH-002-022 – Gazetteer of heritage assets;
- Appendix CH-003-022 – Impact assessment table; and
- Appendix CH-004-022 – Survey reports (this appendix).

1.1.2 Maps referred to throughout the cultural heritage appendices are contained in the Volume 5 cultural heritage map book.

1.2 Surveys undertaken

1.2.1 This appendix contains the results of extensive archaeological surveys undertaken. Key surveys reported in this appendix include:

- LiDAR survey of the majority of the construction area;
- hyperspectral survey of the majority of the construction area;
- a site survey of earthworks at two locations along the route (CN051 and CN055) comprising some 25.7 and 11.6ha respectively; and
- geophysical surveys at five locations along the route (CN044, CN045, CN048, CN052 and CN055) encompassing some 11.2, 7, 13.4, 11 and 9.2ha, respectively.

1.2.2 The results of aerial photographic analysis have been incorporated into the baseline report in Appendix CH-001-022 and are not reported separately for this CFA.

2 LiDAR and hyperspectral survey report

2.1 Introduction

2.1.1 The Whittington to Handsacre CFA extends from Whittington Heath in the south to Handsacre in the north, and comprises largely rural landscape, stretching for some 11.5km, initially on a north to south alignment, before turning to the northwest and continuing on a broadly northwest to southeast alignment.

2.2 Methodology and limitations of analysis

LiDAR data

2.2.1 The filtered LiDAR data was used to create a Digital Terrain Model (DTM), and analysed in the GIS as three rasters comprising elevation data, a hillshade map and a slope map. Similarly, the unfiltered LiDAR data was used to create a Digital Surface Model (DSM) also analysed as elevation data, a hillshade map and a slope map.

2.2.2 Both the DTM and DSM were viewed as rasters in an ArcView GIS project. All identified features were digitised in the GIS from these rasters.

Hyperspectral data

2.2.3 The hyperspectral data was supplied as a series of ENVI DAT raster files, divided into 22 different sections (runs) covering the area of interest (CFA16 to CFA22). Each ENVI DAT contained 34 bands, representing a portion of the electromagnetic spectrum which included visible light and the near-infrared range. The data had a horizontal cell resolution of 1m.

2.2.4 A number of ArcGIS 10's out-of-the-box tools were used to extract, process and analyse the data. Initially, the ENVI DAT files were imported into a mosaic dataset stored within an ArcGIS 10 file geodatabase. A single combined raster dataset, containing the 34 bands, was created from the mosaic dataset.

2.2.5 As no more than three bands can be viewed at once using ArcMap (the red, green and blue bands of the raster dataset) there is a requirement to investigate subsets of the hyperspectral dataset. Particular attention was paid to the near-infrared and the visible red parts of the electromagnetic spectrum, due to the recognised potential of these in helping to highlight archaeological features (Parcak 2009, 101-2). The near-infrared range (760nm to 900nm on the electromagnetic spectrum) covered bands 6 to 13 in the hyperspectral dataset. The visible red range (605nm to 690nm on the electromagnetic spectrum) covered bands 18 to 22 in the hyperspectral dataset.

2.2.6 The near-infrared and visible red bands were extracted from the combined raster dataset, allowing for these bands to be viewed in isolation. Principal Component Analysis was also carried out on these bands using ArcGIS 10's Principal Components tool. The extracted bands were used to generate a series of single output raster datasets for both the near near-infrared and visible red hyperspectral data; this included a single principal component layer dataset and a multiple principal component layer dataset for both ranges. Different principal component layers could then be assigned to the red, green and blue bands of the multiple principal component layers raster datasets.

2.2.7

Digitising

All feature identification was undertaken manually and compared to the results of available aerial photograph evidence. Both hyperspectral and LiDAR plots were examined in detail and features and areas of likely archaeological potential were digitised manually using ArcGIS 10. These features can be seen in Table 1 below. Archaeological features have been assigned a unique WA number, and are briefly described. Where possible broad dates have been suggested based on the form of the features, and the identification of the features has been assigned a confidence rating (based on a simple five point scale (Low, Low to Moderate, Moderate, Moderate to High and High). Where possible, similar features with a common distribution (e.g. former field boundaries or ponds within a coherent area) have been grouped together.

2.2.8

Limitations

The LiDAR data used in the study of this CFA covered extended across most of the land required, temporarily and permanently, for the construction of the Proposed Scheme, with the exception of two areas close to Whittington Heath at the southern end of the route where the land required, temporarily and permanently, for the construction of the Proposed Scheme widens considerably. Only a small portion of the wider 500m study area was covered by the LiDAR data, however. As a result, the majority of sites identified lie within the land required, temporarily and permanently, for the construction of the Proposed Scheme, with only a few from the wider buffer zone.

2.2.9

Much of this stretch of the route is rural, and given over to farmland. Unfortunately, one result of this is that the DSM was less useful than expected as an interpretative tool, as the LiDAR seems to have been flown whilst the crops were fairly well developed. The main result of this is that these crops mask the underlying terrain on the DSM, reducing its effectiveness as an interpretative tool. There is also a fair amount of woodland within this CFA, which masks features on the DSM.

2.2.10

The DTM provides a model of the underlying terrain, stripping away crops and trees. As such it was particularly useful in allowing analysis of areas under trees or woodland. However, even on the DTM, in some areas, low lying ground crops or piles or other obstructions have limited the effectiveness of the LiDAR, with the result that, in a few cases, the ground modelling is far from clear.

2.2.11

Unfortunately, the Hyperspectral data provided did not contain bands representing the mid-infrared range (approximately 850nm to 1300nm on the electromagnetic spectrum). The mid-infrared range is regarded as holding particularly high potential when attempting to identify archaeological features; the Hyperspectral dataset contained no data beyond 992nm on the electromagnetic spectrum.

2.2.12

The horizontal cell resolution of the data also restricted the identification of smaller features (1m intervals) is also likely to have influenced the visibility of small archaeological features and lessened the clarity of some of the larger features.

2.2.13

The effectiveness of Hyperspectral data in identifying archaeology can be significantly influenced by a number of factors, including the nature of the underlying geology, the water content of the ground and the type of ground cover. Significant areas of the route studied lie within dense woodland, where there is no likelihood of features being recognised through analysis of Hyperspectral data, or beneath cereal crops, where the identification of features is

- likely to vary. It also suffers from the same limitations as the LiDAR data in built up areas. Because of these variations, other techniques used for identifying areas of archaeological potential (notably the Normalised Vegetation Data Index (NVDI) and the Water Band Index) were not examined in detail.
- 2.2.14 The Hyperspectral data supplied covered the majority of the land required, temporarily and permanently, for the construction of the Proposed Scheme and much of the 500m study area. The overall coverage provided by the Hyperspectral data is therefore excellent, although because of the number of variables affecting the visibility of features and the limitations in the bandwidth recovered, it should be noted that the features already identified are likely to represent only a portion of those within the CFA.
- 2.2.15 Despite these limitations, it is considered that the available LiDAR and Hyperspectral data provides comprehensive coverage of the land required, temporarily and permanently, for the construction of the Proposed Scheme as well as providing evidence for much of the surrounding 500m study area.
- ## 2.3 Results
- 2.3.1 A total of fifty one sites were identified the various Hyperspectral and LiDAR plots within Community Forum Area 22. The bulk of these were identified on the LiDAR plots, with a smaller number also visible on the Hyperspectral imagery. Many appear on both. These are listed in Table 1 below
- 2.3.2 In keeping with the rural nature of this stretch of the route, the majority of the archaeological sites identified comprise the remains of field boundaries, ponds, hollows (likely to either be infilled ponds or quarries) and occasional survivals of the characteristic earthworks created by 'ridge and furrow' agriculture. The latter developed through the ploughing regimes of the medieval and early post medieval periods, and can provide key evidence of the location and extent of medieval open field systems. Traces of likely ridge and furrow were noted along this stretch of the route – notably within the bounds of Whittington Heath Golf Club (WA22.1).
- 2.3.3 Extensive remains of a field system with trackways and directly associated with areas of ridge and furrow ploughing lie in the vicinity of Wood End Farm (WA22.37 and WA22.38, see Figure 1). These appear to represent the remains of a medieval landscape. Some elements of this landscape now lie in woodland, indicating that some elements of the medieval or post-medieval rural landscape were later allowed to return to woodland, or indeed may have been planted. Combined with the evidence creation of larger fields through the removal of many of the earlier boundaries, this can tell us much about the development of the landscape through the medieval and post-medieval periods.
- 2.3.4 There are a number of small streams within this CFA, and many were harnessed to provide water to power watermills and fill fish ponds. A watermill originally stood at Mill Farm (WA22.11) close to the southern end of the CFA, and the leats which fed water to it and returned it to the stream are still in evidence. Further to the North West, a complex of ponds and ditches East of Wood End Farm (WA22.31, see Figure 2) may be either the site of a mill or a group of fish ponds.
- 2.3.5 A large moat at Streethay marks the site of a Medieval or post-medieval manor. This appears to have been landscaped to form an ornamental feature, and does not appear to have fully enclosed the manor complex (WA22.21, see Figure 3). A second moated site that of Handsacre Hall, lies within Handsacre itself, just beyond the bounds of the CFA.
- 2.3.6 The growing industrialisation of the area in the post-medieval period is demonstrated by the three canals which cross the route – the Wyrley and Essington Canal (WA22.12), the Coventry Canal (WA22.13) and the Trent and Mersey Canal (WA22.32).
- 2.3.7 There is an extensive area of apparent quarrying on Whittington Heath Golf Club (WA22.3) associated with a wide deep trench of uncertain function (WA22.5) and the possible remains of a 19th or 20th century military camp (WA22.4). Of possibly similar date, three roughly square structures at the western end of RAF Lichfield (WA22.34) have the appearance of anti aircraft gun emplacements, whilst a short W shaped ditch may be a slit trench.
- 2.3.8 Other sites of interest include a small circular earthwork on Whittington Heath Gold Club (WA22.2) of unknown origin, an area of linear anomalies to the south west of Marsh Farm (WA22.6, see Figure 4) and a possible barrow mound near Ravenshaw Cottage (WA22.40), although the latter is far from clear on the LiDAR plot. A linear anomaly to the south East of Ashton Haynes Farm (WA22.48) is also undated, but may be a trackway. Close to its southern end is an area of presumably modern tipping (WA22.49)
- ## 2.4 Summary
- 2.4.1 This stretch of the route is largely rural, and the sites are dominated by former field systems, relict boundary ditches, ponds and hollows. Ridge and furrow is evident, suggesting medieval agriculture. Sites of potential significance along the route include a largely intact relict medieval landscape, a moated site, mills and possible fishponds and a possible prehistoric barrow. Later sites include canals, quarries and possible military features.
- ## 2.5 References
- Parcak, S. H. (2009), *Satellite Remote Sensing for Archaeology*. Routledge, Abingdon.
- ## 2.6 Figures
- Figure 1: Sites WA 22.37 and 22.38. Ridge and furrow (green) and former field boundaries (yellow) in the vicinity of Wood End Farm on LiDAR plots
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Figure 2: Site WA 22.28. Ponds and ditches/leats (WA22.31) east of Wood End Farm on the LiDAR plots

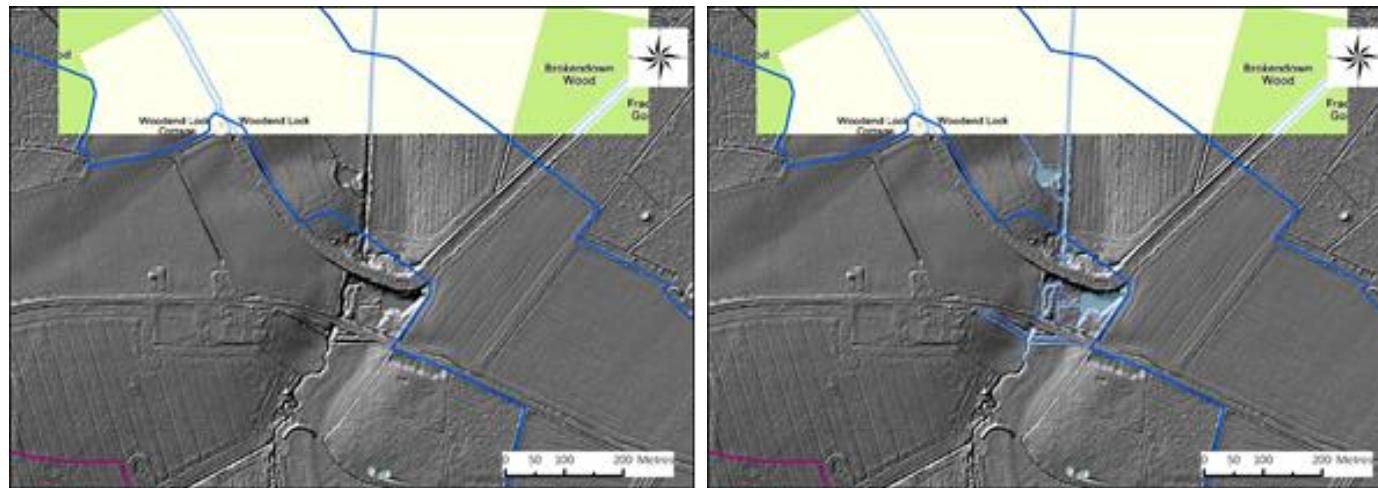


Figure 3: Site WA 22.29. moated site (pink) at Streethay (Hyperspectral Band 6 – Wavelength 900.945nm)

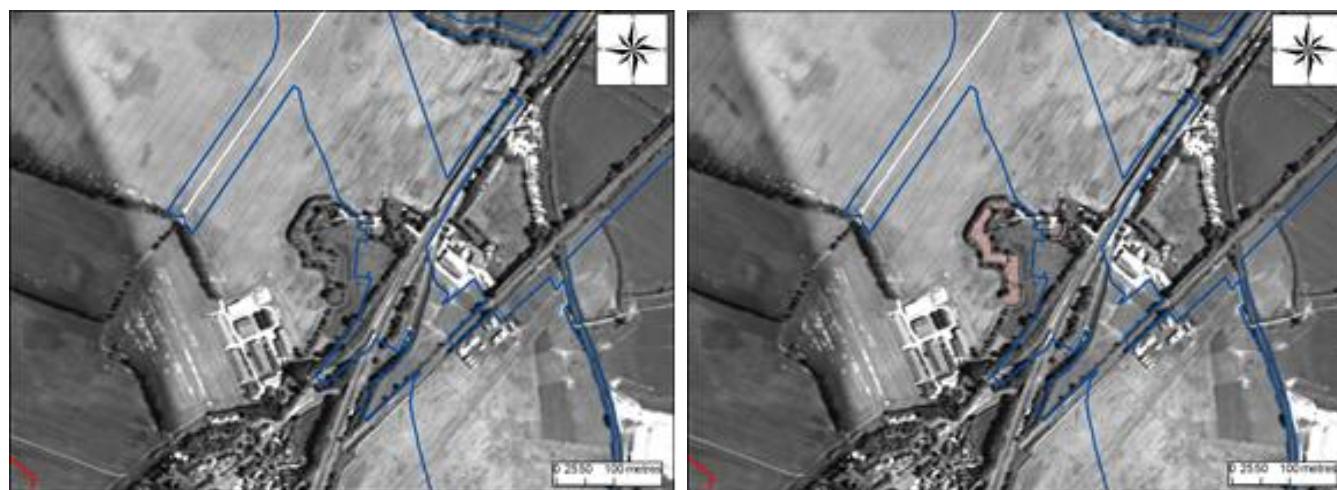


Figure 4: Site WA 22.29. moated site (pink) at Streethay (Hyperspectral Band 6 – Wavelength 900.945nm)

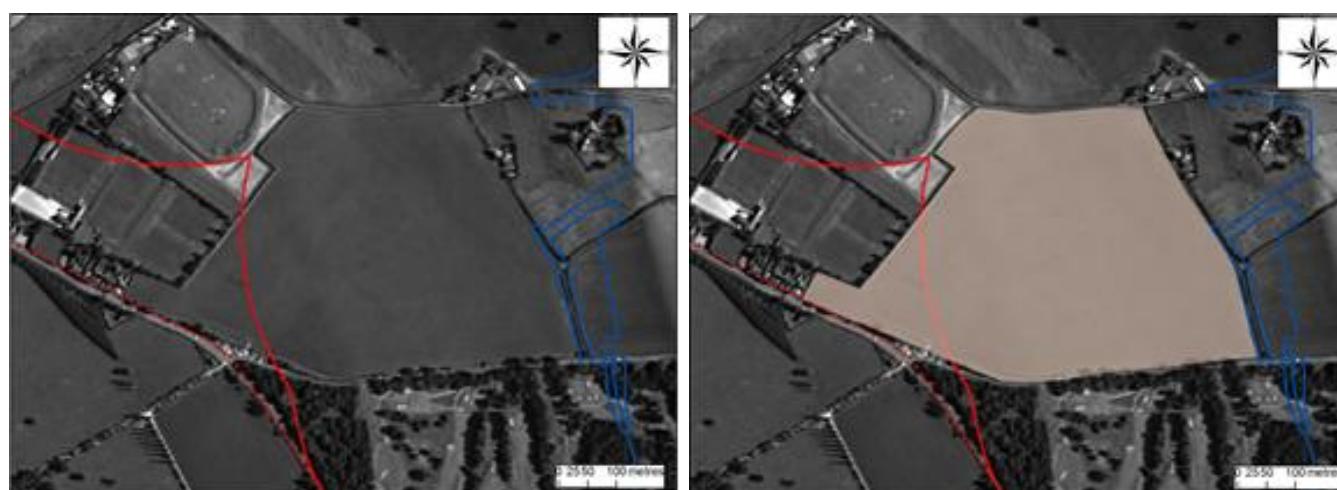


Figure 5: Anomalies within CFA22

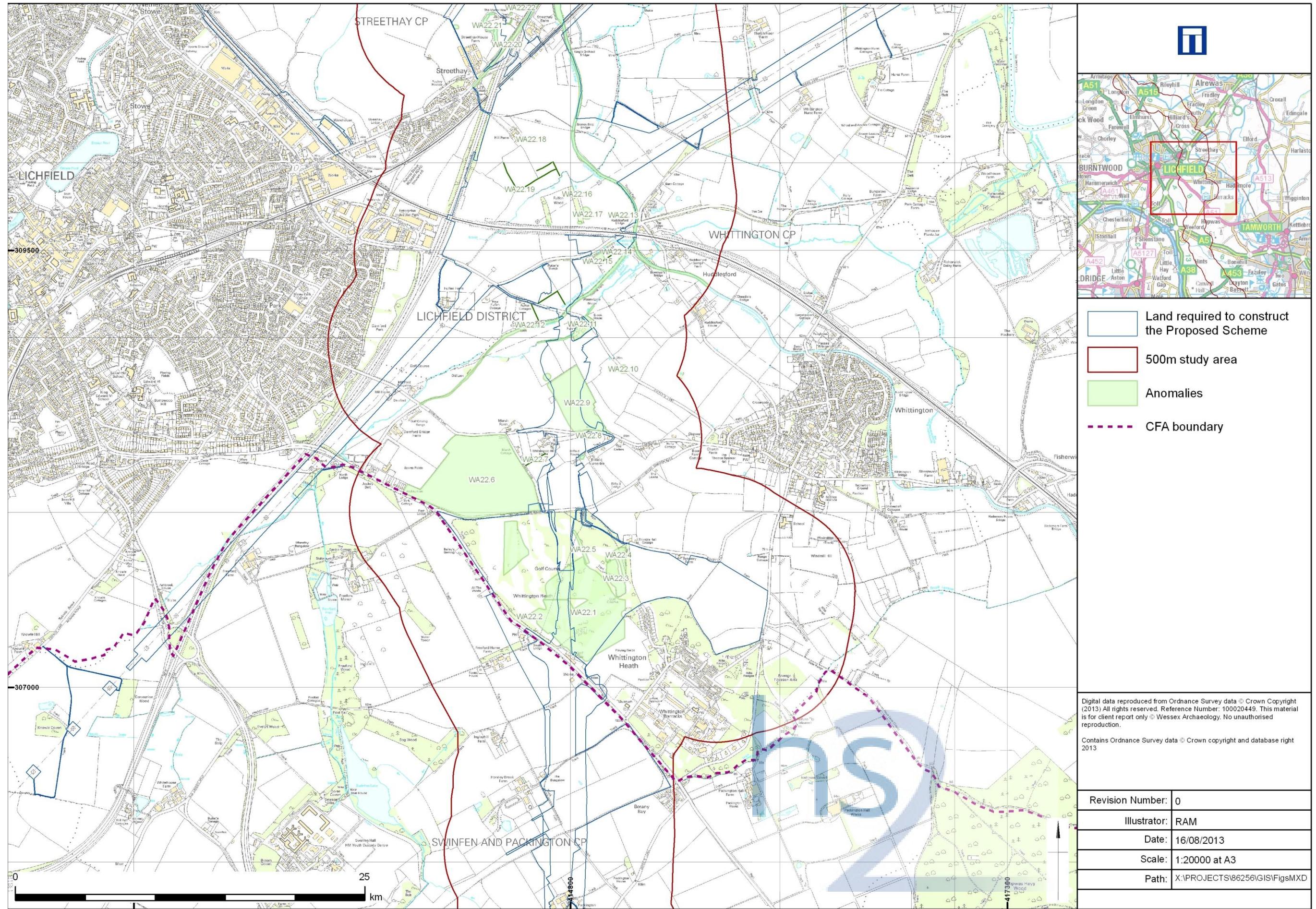


Figure 6: Anomalies within CFA22

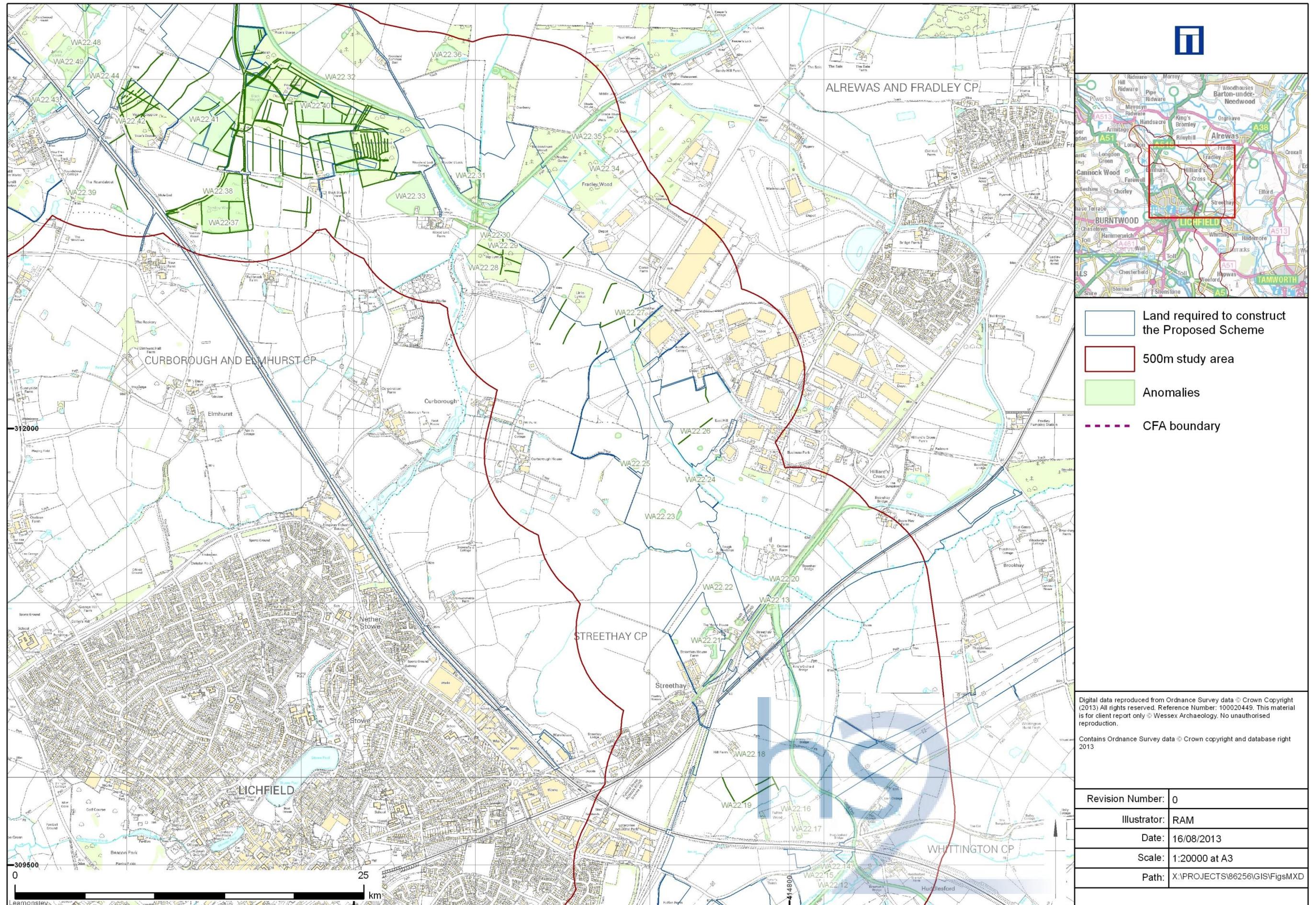
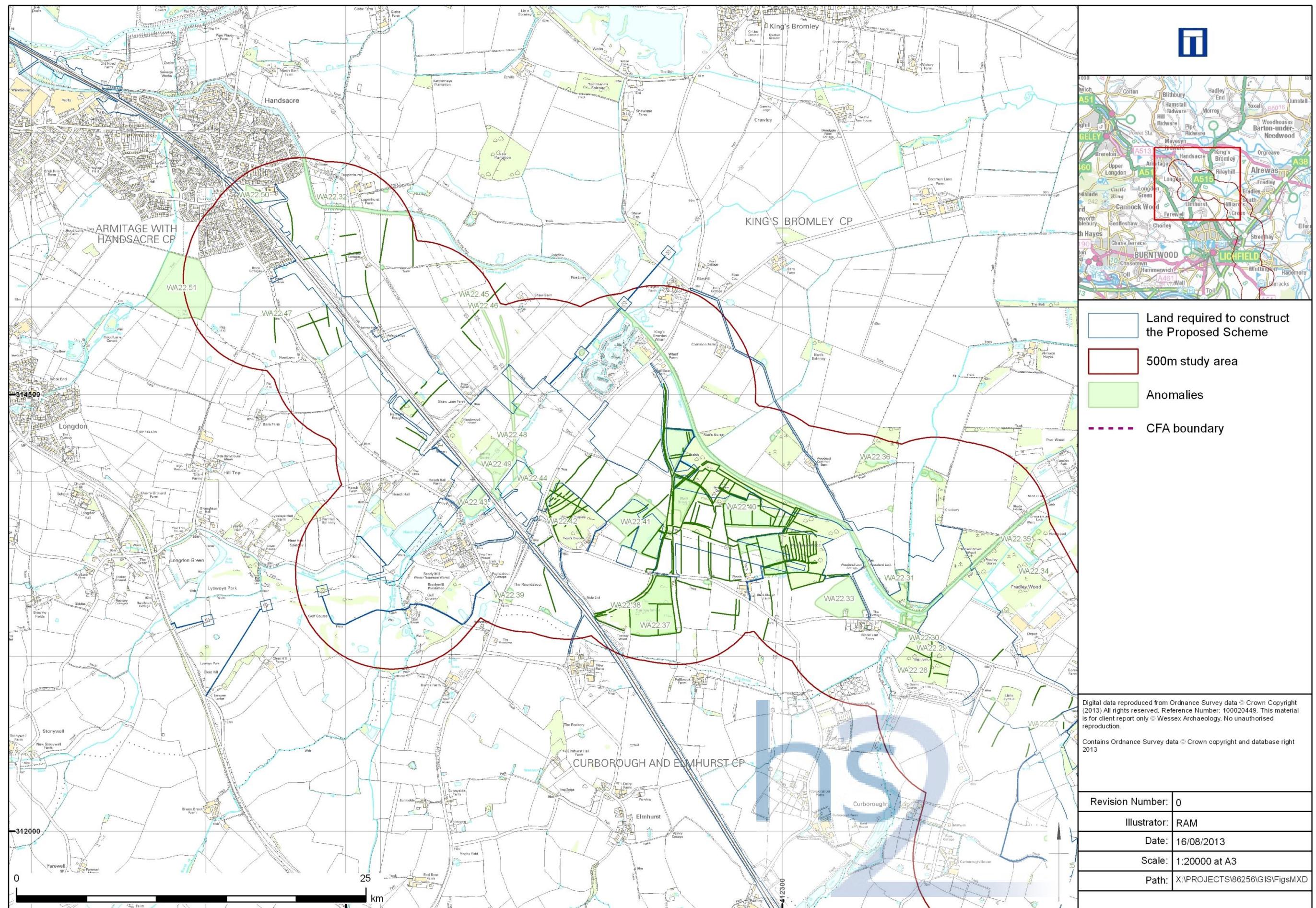


Figure 7: Anomalies within CFA22



2.7 Identified Sites

Table 1: Sites within CFA22

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.1	WHA303	Whittington Heath Golf Club	414850	307350	Extensive remains of linear ridges and furrows. Possibly represent the remains either of an earlier agricultural system, the remains of furrows of a post-medieval plantation. Extend beyond the limits of the limits of the available LiDAR data to the NE. Visible on LiDAR plots	Post-medieval/Modern	Moderate
WA22.2	WHA303	Whittington Heath Golf Club	414564	307404	Small circular earthwork. Defined by a curving ditch some 12m in diameter, apparently with a causeway to the south east and a low external bank. The centre of the earthwork seems relatively flat with the exception of a pit or hollow located off centre to the north east. Visible on LiDAR plots	Unknown, possibly modern	Low to Moderate
WA22.3	WHA303	Whittington Heath Golf Club	415050	307630	Extensive area of probable quarrying within modern golf course. Visible on LiDAR plots	Post-medieval/modern	Moderate
WA22.4	WHA303	Whittington Heath Golf Club	415085	307750	Possible remains of a military camp. Whittington Heath was used as an army camp in the late 19th and 20th centuries. This appears to comprise streets and a regular layout, possibly for tents. Visible on LiDAR plots	Modern?	Low
WA22.5	WHA303	Whittington Heath Golf Club	418870	307820	Broad flat bottomed ditch or trench within the golf course, on a NW-SE alignment. Uncertain function. Visible on LiDAR plots	Undated, but probably modern	Low to Moderate
WA22.6	Modern feature – not included in CH-002-022	SW of Marsh Farm	414270	308200	Number of linear anomalies in large irregular field – may represent the remains of field boundaries or an enclosure. Visible on the Hyperspectral plots.	Undated	Moderate
WA22.7	Modern feature – not included in CH-002-022	SW of Whittington Hill Farm	414605	308305	Single former boundary, marked by low earthwork on NE-SW alignment. Visible on LiDAR plots	Post-medieval/modern	Moderate to High

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.8	Modern feature – not included in CH-002-022	NE of Ellfield House	414900	308425	2 ponds. Possibly former quarries. Visible on LiDAR plots	Post-medieval/modern	Moderate to High
WA22.9	WHA346	N of Darnford Lane	414840	308620	Traces of ridge and furrow in fields to N of road	Post-medieval/Modern	Moderate
WA22.10	Modern feature – not included in CH-002-022	S of Mill Farm	414785	308730	Four large hollows, possibly the remains of earlier quarries.	Undated	Moderate to High
WA22.11	WHA306	Mill Farm	414860	309050	Site of a watermill. Ponds and leats still visible on LiDAR	Medieval/post-medieval	High
WA22.12	WHA308	Wyrley and Essington Canal	414800	309180	Disused stretch of post-medieval/modern canal. Links up to Coventry canal a short distance to the north east. Visible on both LiDAR and Hyperspectral plots	Post-medieval/modern	High
WA22.13	WHA309	Coventry Canal	414815	310195	Post-medieval/modern canal. Connects to the Wyrley and Essington Canal. Visible on both LiDAR and Hyperspectral plots	Post-medieval/modern	High
WA22.14	WHA357	NW of Mill Farm	414720	309263	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. visible on LiDAR plots	Post-medieval/Modern	Moderate to High
WA22.15	WHA357	SW of Huddlesford Bridge	414980	309455	Small area of probable former ridge and furrow on a NE-SW alignment. visible on LiDAR plots	Medieval/post-medieval	Moderate to High
WA22.16	Modern feature – not included in CH-002-022	Fulfen Wood	414850	309655	3 ponds on the edges of woodland, fed by a series of drainage ditches. visible on LiDAR plots	Post-medieval/Modern	Moderate to High
WA22.17	Modern feature – not included in CH-002-022	E of Fulfen Wood.	414895	309710	Large irregular hollow. possibly the site of a former quarry or pond. Visible on LiDAR plots.	Undated	Moderate to High
WA22.18	Modern feature – not included in CH-002-022	SE of Hill Farm	414580	310130	Large pond just to the south east of the farm. Visible on LiDAR plots.	Post-medieval/Modern	Moderate to High
WA22.19	Modern feature – not included in CH-002-022	SE of Hill Farm	414580	309890	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots.	Post-medieval/Modern	Moderate to High

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.20	WHA328	Roman road	414800	311170	Line of Roman road beneath modern roads. Ryknild St. Visible on both LiDAR and Hyperspectral plots.	Roman	High
WA22.21	WHA132	Moated Manor House, Streethay	414310	310805	Substantial moat defining the site of a medieval/post-medieval manor house. Visible on both LiDAR and Hyperspectral plots.	Medieval/post-medieval	High
WA22.22	Modern feature – not included in CH-002-022	N of Streethay	414320	310950	Four roughly oval hollows. May be former quarries or ponds. Visible on LiDAR plots.	Undated	Moderate to High
WA22.23	Modern feature – not included in CH-002-022	SW of East Hill	414290	311450	Group of 4 ponds, all located on or close to modern field boundaries. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.24	Modern feature – not included in CH-002-022	SW of East Hill	414290	311705	Group of 4 ponds, one of which lies in woodland. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.25	Modern feature – not included in CH-002-022	SW of East Hill	413920	311800	Two irregular hollows. May be former quarries or ponds. Visible on LiDAR plots.	Undated	Moderate to High
WA22.26	WHA317	W of East Hill	414260	311990	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.27	Modern feature – not included in CH-002-022	SE of Little Lyntus	413715	312580	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.28	WHA221	Big Lyntus and Little Lyntus	413505	312755	3 ponds on the edges of parcels of woodland, fed by a series of drainage ditches. Visible on LiDAR plots.	Post-medieval/Modern	Moderate to High
WA22.29	WHA221	Big Lyntus and Little Lyntus	413150	312990	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.30	WHA221	Big Lyntus	413100	313110	Large sub rectangular hollow in NW corner of Big Lyntus, with much smaller irregular hollow lying a short distance to the south. Visible on LiDAR plots.	Undated	Moderate to High

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.31	WHA344	E of Wood End Farm	413070	313210	Ponds and water management features in wood. Mill ponds/fishponds? Visible on LiDAR plots.	Medieval/post-medieval/modern	Moderate to High
WA22.32	WHA340	Trent and Mersey Canal	413120	313250	Post-medieval/modern canal with locks, towpaths etc. Visible on both LiDAR and Hyperspectral plots.	Post-medieval/modern	High
WA22.33	Modern feature – not included in CH-002-022	N of Wood End Farm	412660	3133300	Area of linear anomalies visible in the field to the north of Wood End Farm. Probably former field boundaries. Visible on LiDAR plots.	Undated	Moderate
WA22.34	WHA316	RAF Lichfield	413735	313485	3 possible buildings and a possible slit trench relating to the early airfield. Poss. World War II defences. Visible on LiDAR plots.	Modern	Low to moderate
WA22.35	Modern feature – not included in CH-002-022	NW of RAF Lichfield	413635	313670	Large irregular pond close to the canal. Visible on LiDAR plots.	Post-medieval/modern	Moderate to High
WA22.36	Modern feature – not included in CH-002-022	N of Woodend Lock	412850	314140	7 ponds on the edges of or within parcels of woodland, fed by a series of drainage ditches. Visible on LiDAR plots.	Post-medieval/Modern	Moderate to High
WA22.37	WHA224 and WHA321	Wood End Farm and surrounds	412250	313580	Several areas of ridge and furrow ploughing on different alignments associated with numerous relict field boundaries and trackways, many of which now lie in woodland. Aligned broadly N-S, W-E, with some variations. Visible on LiDAR plots.	Medieval/post-medieval/modern	Moderate to High
WA22.38	WHA225 and WHA321	Wood End Farm and surrounds	412320	313545	Extensive relict field system, much of it now in woodland or merged into larger fields. Associated with areas of ridge and furrow ploughing. Likely to be medieval or post-medieval in date. Visible on LiDAR plots.	Medieval/post-medieval/modern	Moderate to High
WA22.39	Modern feature – not included in CH-002-022	Tomhay Wood and surrounds	410950	313255	Four ponds, of varying sizes. All four lie on modern field boundaries.	Post-medieval/Modern	Moderate to High

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.40	WHA321	ESE of Ravenshaw cottage	412075	313860	Possible barrow mound. Not very convincing on LiDAR, but may be obscured by ridge and furrow	?Bronze Age	Low to moderate
WA22.41	WHA324	E of Vicar's Coppice	411480	313720	Apparent traces of ridge and furrow in the fields to the E of Vicar's coppice. Visible on both LiDAR and Hyperspectral plots.	Medieval/post-medieval	Moderate to High
WA22.42	WHA225 and WHA324	Vicar's coppice and surrounds	411090	313805	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots	Post-medieval/modern	Moderate to High
WA22.43	WHA076	SE of Hanch Hall Farm	410520	313880	Poorly defined area of possible ridge and furrow. Possibly suffered later truncation. Visible on LiDAR plots	Medieval/post-medieval	Moderate to High
WA22.44	WHA324	E of Hanch Hall Farm	410795	314195	Five interlinked ponds of varying sizes. Visible on LiDAR plots	Post-medieval/modern	Moderate to High
WA22.45	Modern feature – not included in CH-002-022	NE of Shaw Lane Farm	410535	315070	Two large sub circular hollows. Possibly former ponds or quarries. Visible on LiDAR plots	Undated	Moderate to High
WA22.46	Modern feature – not included in CH-002-022	SE of Handsacre	409645	314855	Series of linear earthworks, probably the remains of former field boundaries or drainage ditches. Visible on LiDAR plots	Post-medieval/modern	Moderate to High
WA22.47	Modern feature – not included in CH-002-022	SE of Handsacre	410170	315560	Series of five ponds, the majority lying on modern field boundaries. Visible on LiDAR plots	Post-medieval/modern	Moderate to High
WA22.48	WHA324	SE of Ashton Haynes Farm	410750	314470	Linear anomaly. Possibly a trackway or road. Appears to show little regard to the modern landscape. Branches at its northern end. Visible on LiDAR plots	Undated	Moderate
WA22.49	Modern feature – not included in CH-002-022	E of Hanch Farm	410665	314120	Industrial/waste tip. Visible on LiDAR plots	Modern	Moderate to High
WA22.50	WHA326	Handsacre	409275	315650	Small area of remnant ridge and furrow. Predominantly aligned WNW-ESE. Visible on LiDAR plots	Medieval/post-medieval	Moderate to High

No	CH-002-022 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA22.51	WHA326	S of Handsacre	408870	315120	Series of earthworks associated with an area of probable ridge and furrow. Moated site or former fishpond? Visible on Hyperspectral plots	Medieval/post-medieval	Moderate to High

3 Site Surveys

3.1 CN051 Land at Ravenshaw Wood, north of Wood End Lane, Elmhurst.

Introduction

Project Background

3.1.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a sketch survey of area CN051, conducted on land at Ravenshaw Wood, north of Wood End Lane, Elmhurst (Figure 8), hereafter “the Site” (centred on NGR 411984 313977). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.1.2 This Site, CN051, was selected for a sketch survey as it is located in an area of proposed major construction works. LiDAR survey identified numerous topographic features of archaeological potential (Wessex Archaeology 2012).

Site details

3.1.3 The Site is made up of dense woodland on land at Ravenshaw Wood, north of Wood End Lane, Elmhurst (Plate 1). It lies approximately 4km north of Lichfield and 4km southeast of Armitage with Handsacre. The woodland comprises an area of 25.7ha contained by the Trent and Mersey Canal to the north east but otherwise surrounded by open pasture associated with Woods Farm and Black Slough Farm.

3.1.4 The Site is surrounded by agricultural land and sits on a gentle west to east slope. The western region of the survey area lies at a height of c.78m aOD (above Ordnance Datum) and falls from this height to a little over 75m aOD at the eastern limit of the Site.

Archaeological Background

3.1.5 The LiDAR interpretation has identified an extensive area of relict field system within the wood (Figure 8) dated to the Medieval and post-medieval period. The remains of this system are densest in the eastern half of the Site with the western woodland showing fewer earthworks surviving. The surrounding pasture also contains evidence of this relict field system with ridge and furrow (WA22.38), former field boundaries and drainage ditches (WA22.37) visible in the LiDAR data to the south and west respectively. A possible barrow is also visible in the fields immediately south of the wood (WA22.40).

Methodology

Survey Objectives

3.1.6 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any earthworks within the site; and
- to determine the general nature of the remains present and confirm the interpretation

suggested by the LiDAR analysis.

3.1.7 This report presents a brief description of the methodology followed, the survey results and the archaeological interpretation of the features identified.

Survey dates

3.1.8 A sketch survey was carried out by Wessex Archaeology between 2 and 5 July 2013.

Instruments Used and Survey Method

3.1.9 The sketch survey employed a mixture of measured and photographic survey.

3.1.10 The proposed methodology for the measured survey was to employ a Leica DGPS (Differential Global Positioning System) in RTK (Real Time Kinematics). All earthwork features were to have their tops and bases surveyed in this fashion along with significant breaks of slope. A loose topographic survey was also recorded to allow any identified features to be viewed in the context of their surrounding landscape.

3.1.11 The dense woodland made this methodology unworkable on the Site (plates 2 and 3). No satellites were visible beneath the canopy and no line of site was visible to the edge of the woodland to allow features to be offset against points located with the GPS. As such, the identified earthworks were recorded by local offsets from a 30m hand tape. Localised plans and profiles were produced and the location of features was recorded on appropriately scaled mapping. This approach is comparable to an enhanced level 1 landscape survey (English Heritage 2007).

3.1.12 The photographic survey comprised two-levels of recording. The first level recorded the general character and nature of the Site with the second level made consisting of detailed shots of individual features. The detailed shots contained a 1m or 2m scale bar as appropriate. The location of photographs was recorded on appropriately scaled mapping showing the location and direction of shot.

3.1.13 The photographic record comprised digital photographs taken with a digital SLR camera. The photographic record was made in tandem with the measured survey.

3.1.14 The full photographic record, together with copies of the marked up plans and a photo gazetteer will be included in the site archive.

Data Processing

3.1.15 Any measured survey undertaken with the Leica DGPS was exported as both .DBX and .TXT files. This system employs the Smartnet Corrections service and as such provides a real time accuracy with an average plus or minus of 0.02m. The exported data was subsequently processed within Wessex Archaeology's in house software and exported to AutoCAD (AutoCAD map 3D 2011) as a .DWG file.

3.1.16 This report contains plans showing the location of identified earthworks and features on Ordnance Survey base mapping. Plans and profiles are also included where these enhance the understanding of the feature.

3.1.17 Selected photographs from the photographic survey have been included within this report, whilst smaller scale copies of the photographs are incorporated within the accompanying gazetteer.

Results

Introduction

- 3.1.18 The sketch survey has confirmed the presence of the relic field system recorded in the LiDAR survey of the woodland (Figure 8). However, due to the dense woodland and very poor visibility only isolated sections of these earthworks were able to be located and recorded.
- 3.1.19 A large field boundary ditch (feature 1, 11, 12 and 14) defines the eastern half of the woodland and separates it from the surrounding pasture (Figure 9). Within this boundary and under the canopy of the woodland a series of north-south drainage ditches were recorded (features 2-10) as well as a section of east-west aligned ridge and furrow (feature 16). This ridge and furrow was contained by a succession of staggered smaller field boundary ditches running north-south (features 15 and 17).
- 3.1.20 Within the thin east-west aligned central strip of the woodland a series of modern trackways (feature 20) and drainage ditches were recorded (features 18, 19 and 21).
- 3.1.21 The western half of Ravenshaw Wood was incredibly dense with water filled boundary ditches surrounding it. The limited number of trackways within the western wood made access impossible to large sections of its interior. The only significant point of access was a modern roadway (feature 23) which serviced a property adjacent to the pasture to the south of the woods central belt. A number of field boundary and drainage ditches were observed as they abutted this roadway (features 22, 24, 25, 26, 27). No other earthworks were able to be identified within the interior of the western wood.

Interpretation: Archaeology

- 3.1.22 Feature 1: A north-south aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood (Plate 4). The boundary ditch is still in use and measures 2.5m wide and survives to a depth of 0.8m along this segment (Figure 10). This earthwork is part of a system of field boundary ditches that separate the woodland from surrounding pasture and is related to ditch features 11, 12 and 14. This field boundary system contains features 2-10, 13 and 15-17. All of these features are likely to originate in the Medieval period.
- 3.1.23 Feature 2: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m (Figure 9). This earthwork is one of 11 identical earthworks identified in the LiDAR data running along the same alignment and evenly spaced with a gap of approximately 10m between each ditch (Plate 5). This system of drainage ditches merge at their southern limit with the double ditches running east-west that define the limits of a trackway (feature 6) providing access through the wood. It is assumed but not observed that the northern extent of these drainage ditches merge with the large field boundary ditch (features 1, and 11) that define the extent of the eastern wood.
- 3.1.24 Feature 3: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.1m. (see description of feature 2 for further discussion).
- 3.1.25 Feature 4: An ephemeral north-south aligned drainage ditch measuring 1.2m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).
- 3.1.26 Feature 5: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).

- 3.1.27 Feature 6: An east-west aligned trackway providing access across the dense eastern section of Ravenshaw Wood (Plate 6). The trackway is defined by ephemeral drainage ditches located immediately to the south and north of the track. The track is some 2.5m wide with its associated drainage ditches surviving to a width of 1.2m and a depth of 0.15m (Figure 9). The sketch survey has shown that the northern drainage ditch merges with features 2-5 and 7-10 to the north. The southern ditch merges with feature 10 to the south. LiDAR data suggests this trackway continues to the west across the open pasture before terminating at a north-south aligned field boundary. To the east, feature 6 terminates as it reaches north-south aligned field boundary 11.
- 3.1.28 Feature 7: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).
- 3.1.29 Feature 8: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).
- 3.1.30 Feature 9: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).
- 3.1.31 Feature 10: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m. (see description of feature 2 for further discussion).
- 3.1.32 Feature 11: A north-south aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood (Plate 7). The boundary ditch is still in use and measures 2.8m wide and survives to a depth of 0.6m along this segment (Figure 10). This earthwork is part of a system of field boundary ditches that separate the woodland from surrounding pasture and is related to ditch features 1, 12 and 14. This field boundary system contains features 2-10, 13 and 15-17. All of these features are likely to originate in the Medieval period.
- 3.1.33 Feature 12: A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood (Figure 9). The boundary ditch is still in use and could not be accessed due to safety concerns. The ditch is of an approximate size to feature 11. This earthwork is part of a system of field boundary ditches that separate the woodland from surrounding pasture and is related to ditch features 1, 11 and 14. This field boundary system contains features 2-10, 13 and 15-17. All of these features are likely to originate in the Medieval period.
- 3.1.34 Feature 13: An ephemeral north-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m (Figure 9). The feature was only observed at its northern terminus as it merges with field boundary 11. Based on the LiDAR data the feature is assumed to continue to the south before turning 90 degrees to the west and connecting with feature 10 to the west. (see description of feature 2 for further discussion).
- 3.1.35 Feature 14: A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood (Figure 9). The boundary ditch is still in use and measures 2.0m wide and survives to a depth of 0.6m along this segment. This earthwork is part of a system of field boundary ditches that separate the woodland from surrounding pasture and is related to ditch features 1, 11 and 12. This field boundary system contains features 2-10, 13 and 15-17. All of these features are likely to originate in the Medieval period.

3.1.36	Feature 15: An ephemeral northeast-southwest aligned drainage ditch (Figure 10) measuring 1m wide and surviving to a depth of 0.15m (Plate 8). This ditch runs parallel to drainage ditch 17, situated 5m to the west and is located 10m to the east of field boundary ditch 14. Both drainage ditches 15 and 17 run parallel to boundary ditch 14 which defines the extent of the earthworks to the north and south. Drainage ditch 15 defines the western limit of northwest-southeast aligned ridge furrow (feature 16).	3.1.43	Feature 22: A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood (plate 12). The boundary ditch is still in use and measures 3m wide and survives to a depth of 1.3m along this segment (Figure 11). This earthwork is part of a system of field boundary ditches (along with feature 24 and 27) that separate the woodland from surrounding pasture to the south and west of modern roadway23. Boundary ditch 22 continues to the north of this roadway into dense woodland until it meets the Trent and Mersey Canal to the north. This boundary ditch serves to demarcate the western woodland as a separate pocket of land in much the same way that boundary ditches 1, 11, 12 and 14 do for the eastern woodland.
3.1.37	Feature 16: A well preserved but heavily obscured area of ridge and furrow aligned northwest-southeast (Plate 9). The furrows survive to a width of 0.8m and a depth of 0.2m and spaced 1.9m apart with a very slightly raised ridge separating them (Figure 11). The area is very heavily overgrown and covered with leaf litter and bracken. The earthworks are bounded to the north and south by ditch 14 and to the west by ditch 15. The eastern extent of the earthwork was never observed due to the density of the woodland but the LiDAR data indicates that the ridge and furrow continues to the edge of the woodland and is defined by boundary ditch 14.	3.1.44	Feature 23: A modern roadway servicing a property adjacent to the pasture to the south of the woods thin central belt (Figure 9). The road survives as a metalled surface some 3 metres wide running south to north from Wood End Lane before turning 90 degrees within Ravenshaw Wood and arriving at an occupied property. The road bisects field boundary ditch 22.
3.1.38	Feature 17: An ephemeral northeast-southwest aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m (Figure 9). This ditch runs parallel to drainage ditch 15, situated 5m to the east and is located 5m to the east of field boundary ditch 14. Both drainage ditches 15 and 17 run parallel to boundary ditch 14 which defines the extent of the earthworks to the north and south.	3.1.45	Feature 24: A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood (Plate 13). The boundary ditch is still in use and measures 3m wide and survives to a depth of 1.8m along this segment. This earthwork is part of a system of field boundary ditches (along with feature 22 and 27) that separate the woodland from surrounding pasture to the south and west of modern roadway23. Boundary ditch 24 continues to the north of this roadway into dense woodland until it meets the Trent and Mersey Canal to the north. This boundary ditch serves to demarcate the western woodland as a separate pocket of land in much the same way that boundary ditches 1, 11, 12 and 14 do for the eastern woodland.
3.1.39	Feature 18: A northwest-southeast aligned drainage ditch (Figure 11) surviving to a width of 2m and a depth of 0.8m (Plate 10). Only the eastern extent of the earthwork was identified before it entered the dense woodland that makes up the thin central belt of Ravenshaw Wood. However, the feature continues for several hundred metres to the west according to the LiDAR data before terminating as it meets field boundary ditch 22. The earthwork terminates to the east as it meets drainage ditch 15, which it respects. The feature runs parallel with drainage ditch 19 which is located 15m to the north.	3.1.46	Feature 25: An east-west aligned drainage ditch surviving to an approximate size of 1.5m wide and 0.5m deep. The dimensions are only approximate as it was impossible to gain access to the feature as large boundary ditch 24 was water filled and barred access to the interior of the western wood. The feature is visible on the LiDAR data with its western terminus abutting field boundary ditch 24 and its eastern terminus merging with a series of northeast-southwest aligned linear features that extend beyond the western limit of Ravenshaw Wood and into arable land to the southwest.
3.1.40	Feature 19: A northwest-southeast aligned drainage ditch surviving to a width of 2m and a depth of 0.4m (Figure 9). Only the eastern extent of the earthwork was identified before it entered the dense woodland that makes up the thin central belt of Ravenshaw Wood. However, the feature continues for several hundred metres to the west according to the LiDAR data before terminating as it meets field boundary ditch 22. The earthwork terminates to the east as it meets field boundary ditch 14, which it respects. The feature runs parallel with drainage ditch 18 which is located 15m to the south.	3.1.47	Feature 26: An ephemeral east-west aligned drainage ditch surviving to a width of 0.8m wide and a depth of 0.1m (Plate 14). The feature was observed in isolated segments between field boundary ditches 27 and 24. The earthwork is visible on the LiDAR data continuing to the east of field boundary ditch 24 although this wasn't observed on the ground due to access problems.
3.1.41	Feature 20: An east-west aligned trackway servicing a property adjacent to the pasture to the south of the woods thin central belt (Plate 11). The trackway is defined by ephemeral drainage ditches located immediately to the south and north of the track (Figure 9). The track is some 3m wide with its associated drainage ditches surviving to a width of 1.2m and a depth of 0.3m. Stone lined drainage ditch 21 abuts the northern drainage gully of the trackway at its western terminus. The trackway terminates to the east as it reaches the open pasture to the south of the thin central belt of Ravenshaw Wood. The trackway sits just north of the property which it services along with modern roadway 23 to the west.	3.1.48	Feature 27: A north-south aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood. The boundary ditch is still in use and measures 2m wide and survives to a depth of 1.2m along this segment. This earthwork is part of a system of field boundary ditches (along with feature 22 and 24) that separate the woodland from surrounding pasture and arable land.
3.1.42	Feature 21: A stone lined drainage ditch aligned southwest to northeast. The ditch survives to a width of 0.8m and a depth of 0.5m (Figure 9). The southern limit of the drainage ditch abuts pathway 20 with its northern limit abutting northwest-southeast aligned drainage ditch 18.	3.1.49	<h2>Conclusions</h2> <h3>Introduction</h3> <p>The sketch survey has confirmed the presence of a large area of relic field system (WA22.36) within Ravenshaw Wood. The woodland is segmented into three distinct areas by a series of large extant field boundaries; a well-defined eastern woodland, a thin central belt of woodland</p>

and a well-defined western woodland. The sketch survey has identified a series of drainage ditches and areas of ridge and furrow previously identified in the LiDAR data and confirmed their archaeological significance. Despite the lack of DGPS signal and very poor visibility under the canopy a significant number of archaeological features have been located and characterised, with only sections of the western woodland remaining unsurveyed.

Discussion

- 3.1.50 The methodology for the sketch survey had to be amended significantly due to the density of the woodland on Site and the subsequent inability to use the DGPS for metric survey. Indeed, the woodland was so dense and had such thick ground cover that many earthworks were only able to be identified in isolated patches with sections of the western woodland not accessible at all.
- 3.1.51 The eastern woodland was defined by a series of extant field boundary ditches (features 1, 11, 12 and 14) with a broad east-west aligned trackway (feature 6) allowing access. This boundary ditch serves to demarcate the eastern woodland as a separate pocket of land to the surrounding pasture and arable farmland. To the north of trackway 6 a series of parallel north-south aligned drainage ditches were recorded which served to divide the woodland into thin strips of land approximately 10m wide. This tight parcelling of land is confined to this particular area of the eastern woodland with its limits defined by boundary ditches 1 and 11. To the north of boundary ditch 1/11 and defined by boundary ditches 12 and 14 a northwest-southeast aligned area of ridge and furrow was recorded. Only a small patch of ridge and furrow was able to be identified on the ground but much more is visible in the LiDAR data.
- 3.1.52 The thin central belt of Ravenshaw is defined by a small boundary ditch to the south and the Trent and Mersey Canal to the north. Within this strip of Woodland three drainage ditches were found (features 18, 19 and 21). The only other notable feature was a trackway (feature 20) which services a property adjacent to the pasture to the south of the woods thin central belt.
- 3.1.53 The western woodland was defined by a series of extant field boundary ditches (features 22, 24 and 27) with a broad metalled roadway (feature 23) allowing access from Wood End Lane to a property adjacent to the pasture to the south of the woods thin central belt. Within this stretch of woodland only a couple of drainage ditches were able to be identified (features 25 and 26). The LiDAR data suggests a significant number of additional drainage ditches were present as well as a possible northeast-southwest aligned trackway which continues into arable land to the southwest. The density of the woodland and often complete coverage of the forest floor with leaf litter and bracken meant that these features were impossible to locate on the ground. Indeed, the lack of paths and depth of water filled boundary ditches meant access was impossible to much of the western woods interior.
- 3.1.54 The sketch survey has successfully identified and characterised much of the Medieval to post-medieval relic field system identified in the LiDAR interpretation (WA22.37).
- 3.1.55 The sketch survey has highlighted the accuracy of the LiDAR survey even under the canopy of dense woodland. Visibility and access was problematic in the western woodland due to the dense canopy and problems of crossing water filled boundary ditches. However, given the accuracy of the LiDAR data elsewhere on Site it seems likely that earthworks identified in the LiDAR interpretation where present even though they weren't observed on the ground. A follow up visit in winter with reduced vegetation would confirm this.

References

Bibliography

- English Heritage (2007), *Understanding the Archaeology of Landscapes. A guide to good recording practice*.
- Wessex Archaeology (2012), *LiDAR analysis: Community Forum Area 7 (Whittington to Handsacre)*.
- Wessex Archaeology (2012), *LiDAR analysis: Community Forum Area 5 (Curdworth to Middleton)*.
- Wessex Archaeology (2013), *HS2 Method Statement for Field Survey*. Report reference 86254.54

Table 2: Gazetteer of identified features

Feature ID	Description	NGR	
1	Large field boundary ditch defining edge of eastern Ravenshaw Wood. Ditch 2.5m wide and survives to a depth of 0.8m	412315, 313548	
2	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412330, 313549	
3	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.1m	412347, 313553	

Feature ID	Description	NGR	
4	North-south aligned drainage ditch measuring 1.2m wide and surviving to a depth of 0.15m	412367, 313556	
5	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412385, 313559	
6	East-west aligned trackway, 2.5m wide with its associated drainage ditches surviving to a width of 1.2m and a depth of 0.15m	412345, 313547	
7	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412403, 313553	

Feature ID	Description	NGR	
8	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412418, 313551	
9	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412435, 313545	
10	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412454, 313540	

Feature ID	Description	NGR	
11	A north-south aligned field boundary ditch defining eastern Ravenshaw Wood, measuring 2.8m wide and surviving to a depth of 0.6m	412466, 313540	
12	A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood. Not metrically surveyed due to access problems	412536, 313639	

Feature ID	Description	NGR	
13	North-south aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412528, 313633	
14	A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the eastern half of Ravenshaw Wood. The boundary ditch is still in use and measures 2.m wide and survives to a depth of 0.6m	412313, 313734	

Feature ID	Description	NGR	
15	Northeast-southwest aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15m	412335, 313733	
16	Heavily obscured area of ridge and furrow aligned northwest-southeast. The furrows survive to a width of 0.8m and a depth of 0.2m and spaced 1.9m apart with a very slightly raised ridge separating them	412423, 313776	
17	Northeast-southwest aligned drainage ditch measuring 1m wide and surviving to a depth of 0.15	412336, 313756	

Feature ID	Description	NGR	
18	A northwest-southeast aligned drainage ditch surviving to a width of 2m and a depth of 0.8m. Only the eastern extent of the earthwork was identified	412324, 313826	
19	Northwest-southeast aligned drainage ditch surviving to a width of 2m and a depth of 0.4m. Only the eastern extent of the earthwork was identified before it entered the dense woodland that makes up the thin central belt of Ravenshaw Wood	412338, 313864	

Feature ID	Description	NGR	
20	An east-west aligned trackway servicing a property adjacent to the pasture to the south of the woods thin central belt. The trackway is defined by ephemeral drainage ditches located immediately to the south and north of the track. The track is some 3m wide with its associated drainage ditches surviving to a width of 1.2m and a depth of 0.3m	412016, 313925	
21	A stone lined drainage ditch aligned southwest to northeast. The ditch survives to a width of 0.8m and a depth of 0.5m	411939, 313975	

Feature ID	Description	NGR	
22	A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood. The boundary ditch is still in use and measures 3m wide and survives to a depth of 1.3m	411810, 313935	
23	A modern roadway servicing a property adjacent to the pasture to the south of the woods thin central belt. The road survives as a metalled surface some 3 metres wide running south to north from Wood End Lane before turning 90 degrees within Ravenshaw Wood and arriving at an occupied property	411678, 314013	
24	A northeast-southwest aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood. The boundary ditch is still in use and measures 3m wide and survives to a depth of 1.8m	411697, 314090	

Feature ID	Description	NGR	
25	An east-west aligned drainage ditch surviving to an approximate size of 1.5m wide and 0.5m deep. Not metrically surveyed due to access issues	411729, 314144	
26	East-west aligned drainage ditch surviving to a width of 0.8m wide and a depth of 0.1m	411688, 314136	
27	A north-south aligned section of the large field boundary ditch which defines the extent of the western half of Ravenshaw Wood. The boundary ditch is still in use and measures 2m wide and survives to a depth of 1.2m along this segment	411642, 31413	

Figures

Figure 8: Site location with LiDAR data

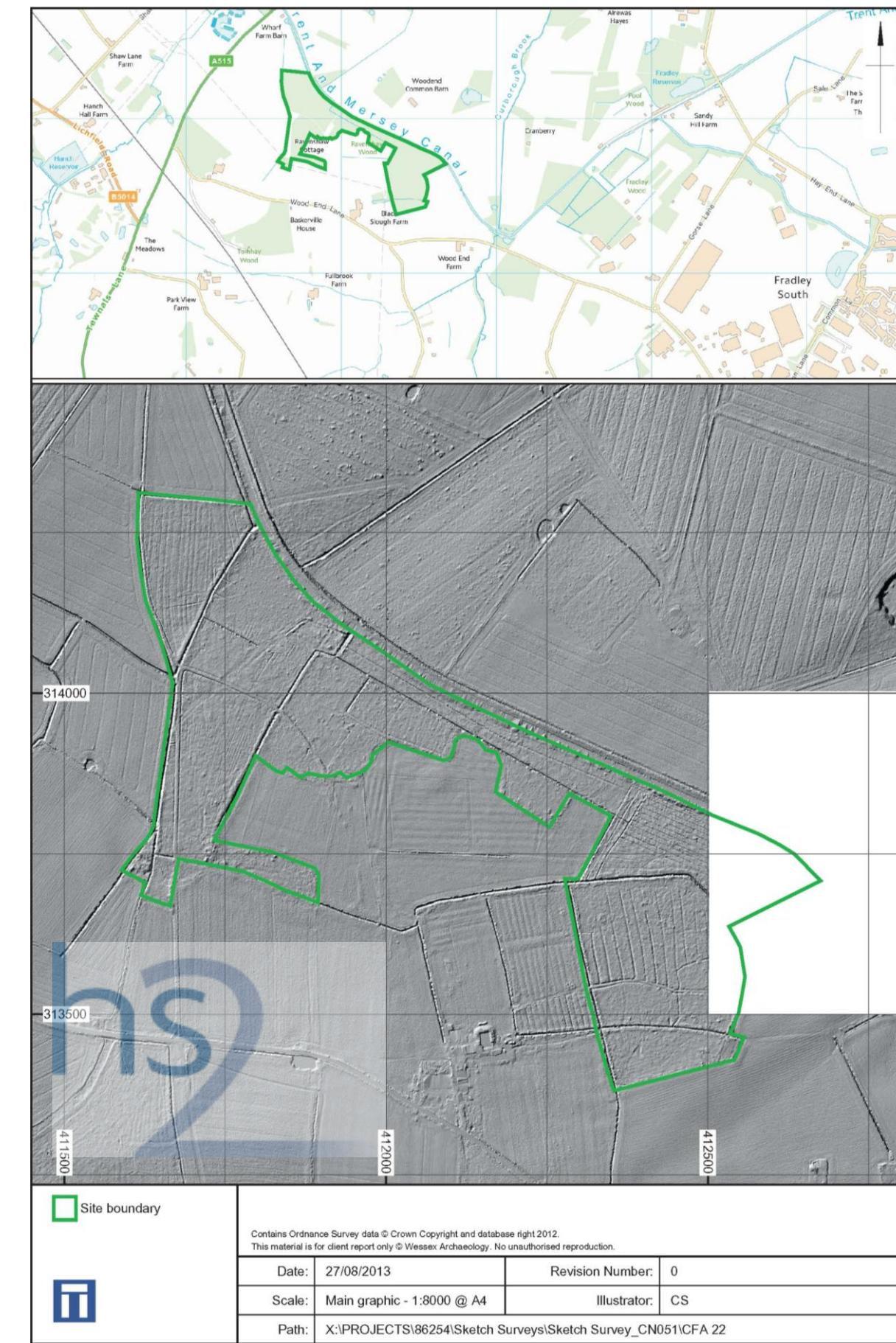


Figure 9: Plan of identified features on LiDAR data



Figure 10: Profiles across features 1, 11 and 15

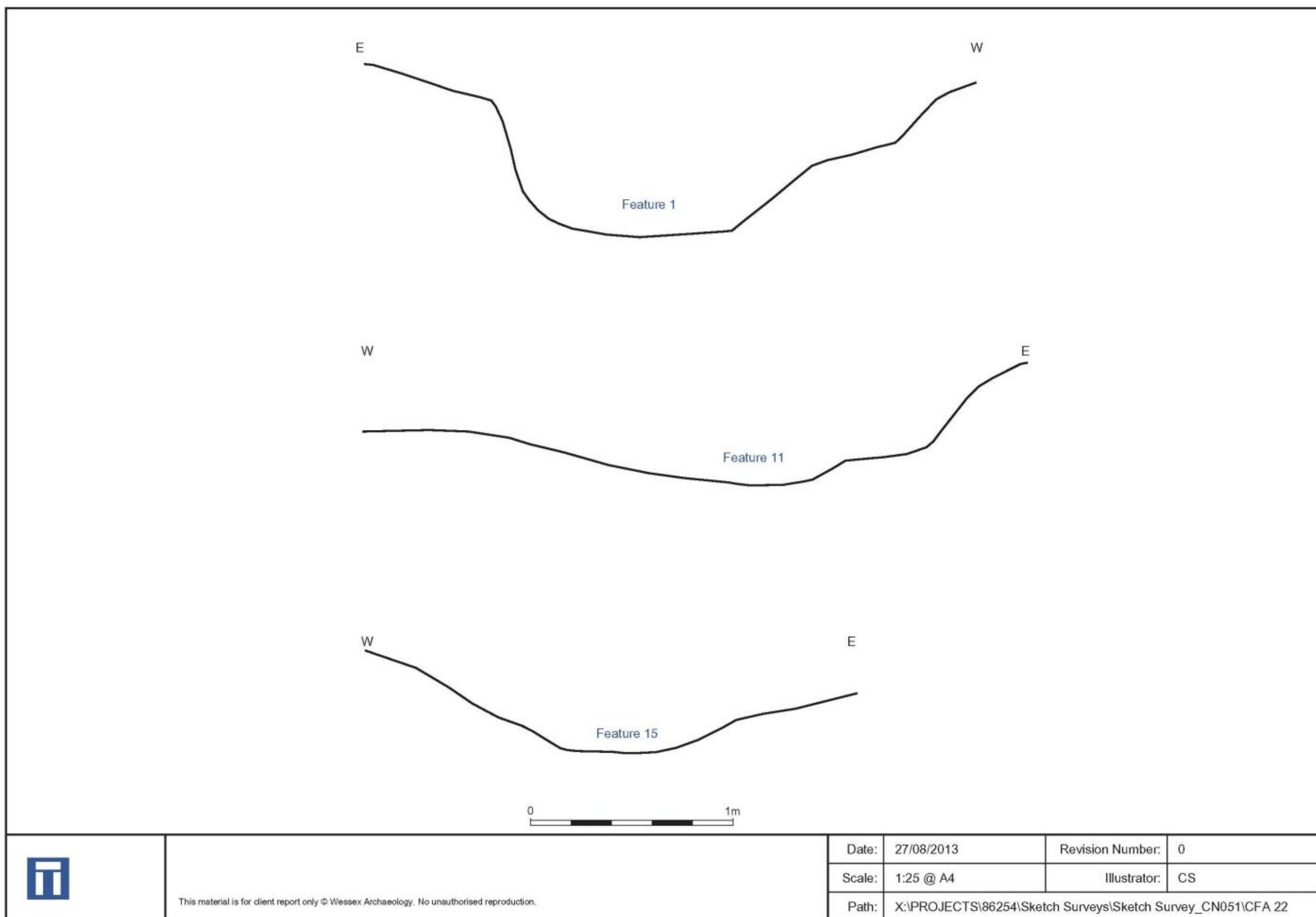
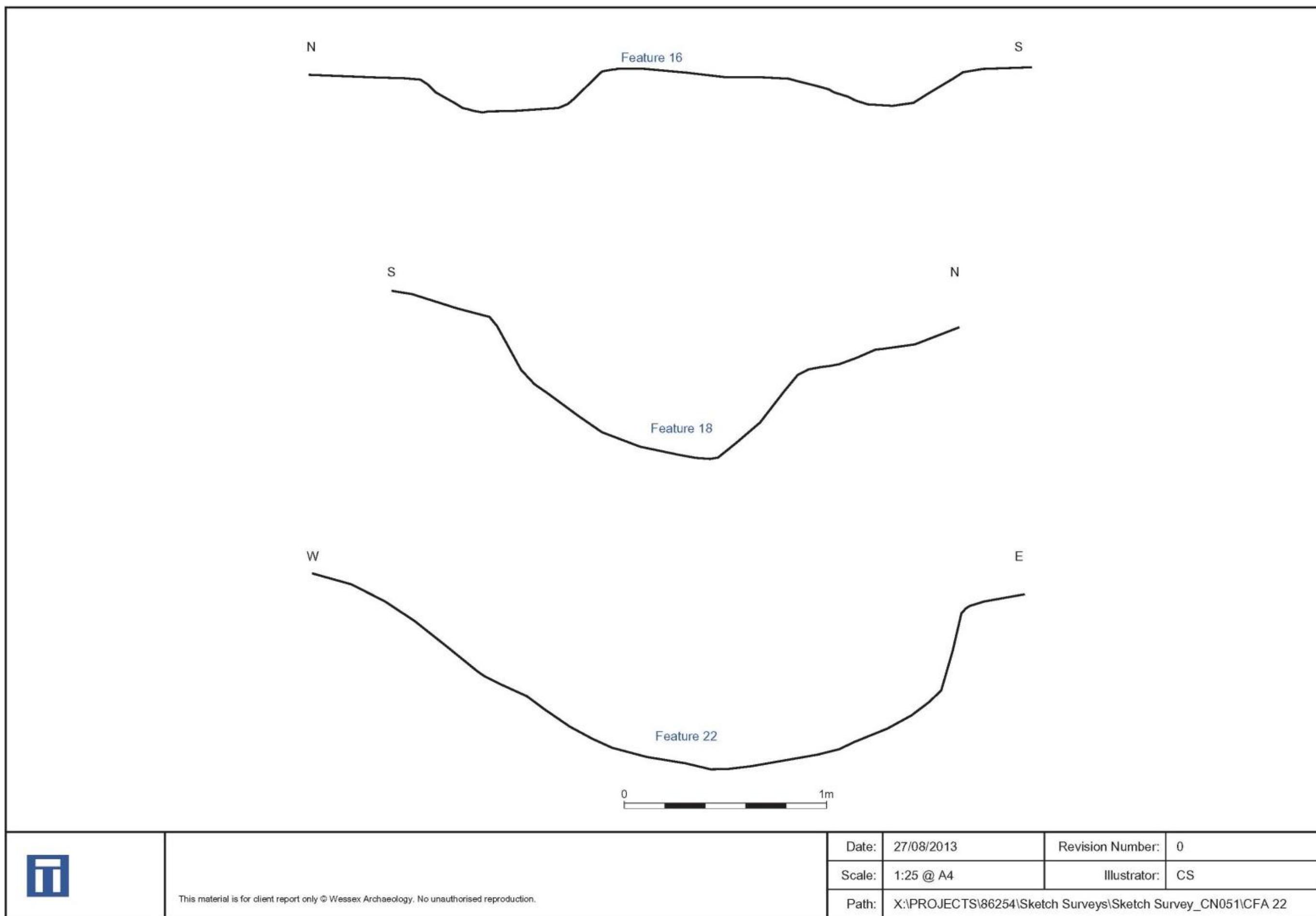


Figure 11: Profiles across features 16, 18 and 22



Plates



Plate 1: General shot of exterior of Ravenshaw Wood, facing northeast



Plate 3: General shot of western wood showing density of foliage



Plate 2: General shot of eastern wood showing density of foliage



Plate 4: General shot of boundary ditch (feature 1) defining extent of the eastern wood



Plate 5: General shot of north-south aligned drainage ditch (feature 7) north of trackway 6. Feature 7 is indicative of drainage ditches 1-5, 7-10 and 13

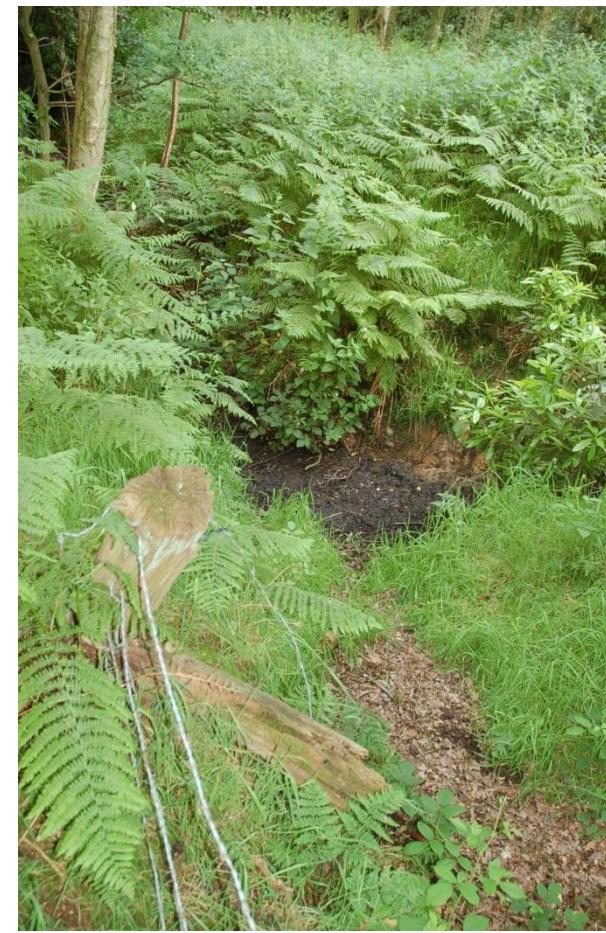


Plate 7: Interface of boundary ditches 11 and 12, defining edge of eastern wood. Facing northeast



Plate 6: Feature 6, east-west aligned trackway through eastern wood. Facing east



Plate 8: Feature 15, northeast-southwest aligned drainage ditch. Facing northeast



Plate 9: Feature 16, general shot of heavily obscured ridge and furrow, facing east



Plate 11: Feature 20, trackway leading from thin central belt of woodland to pasture. Facing east



Plate 10: Feature 18, general shot of drainage ditch. Facing northwest



Plate 12: Feature 22, general shot of boundary ditch within western wood. Facing northeast



Plate 13: Feature 24, general shot of boundary ditch defining extent of western wood. Facing northeast



Plate 14: Feature 26, general shot of drainage ditch. Facing northwest

3.2 CNo55 Land south east of Shaw Lane, Hanch, Lichfield

Introduction

Project Background

3.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a sketch survey of area CNo55, conducted on land southeast of Shaw lane, Hanch, Lichfield (Figure 12), hereafter "the Site" (centred on NGR 410657 314159). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.2.2 This Site, CNo55, was selected for a sketch survey as it is located in an area of proposed major construction works. LiDAR survey identified several topographic features of archaeological potential (Wessex Archaeology 2012).

Site details

3.2.3 The Site comprises a mix of copse woodland and pasture (Plate 1) on land southeast of Shaw lane, Hanch, Lichfield. It lies approximately 4.7km north of Lichfield and 2.5km southeast of Armitage with Handsacre. The field and copse woodland make up an area of 11.6ha contained by railway lines to the south with Shaw Lane and Bourne Brook providing barriers to the west and east respectively. The land to the north is made up of farmland and is separated from CNo55 by a field boundary.

3.2.4 The Site is surrounded by agricultural land and sits on a gentle west to east slope. The western region of the survey area lies at a height of c.78m aOD (above Ordnance Datum) and falls from this height to a little over 74m aOD at the eastern limit of the Site. The Site contains several outcrops copse woodland.

Archaeological Background

3.2.5 Three areas of archaeological interest have been previously identified from the LiDAR survey (Figure 12). LiDAR data highlighted a large rectangular mound in the centre of the survey area centred on 410643, 314158. This mound is presumed to be modern (Wessex Archaeology 2012). At the western limit of the site a southeast to northwest aligned linear has been identified of unknown date. Five interlinked ponds of Medieval origin have also been identified, one of which falls within the site boundary of CNo55 (feature 4).

3.2.6 Beyond these three identified features several anomalies were also visible in the LiDAR data. Within the north-western field of CNo55 a southwest to northeast aligned linear was visible. Within the field at the southeast limit of the Site several additional southwest to northeast aligned anomalies were visible.

Methodology

Survey Objectives

3.2.7 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any earthworks within the site; and

	<ul style="list-style-type: none"> to determine the general nature of the remains present and confirm the interpretation suggested by the LiDAR analysis. 	
3.2.8	This report presents a brief description of the methodology followed, the survey results and the archaeological interpretation of the features identified.	3.2.19
	Survey Dates	
3.2.9	A sketch survey was carried out by Wessex Archaeology between the 2nd and 5th July 2013.	3.2.20
	Instruments Used and Survey Method	
3.2.10	The sketch survey employed a mixture of measured and photographic survey.	3.2.21
3.2.11	The proposed methodology for the measured survey was to employ a Leica DGPS (Differential Global Positioning System) in RTK (Real Time Kinematics). All earthwork features were to have their tops and bases surveyed in this fashion along with significant breaks of slope. A loose topographic survey was also recorded to allow any identified features to be viewed in the context of their surrounding landscape.	3.2.22
3.2.12	The dense copse woodland made this methodology unworkable on roughly approximately 25% of the Site. No satellites were visible beneath the canopy and no line of site was visible to the edge of the woodland to allow features to be offset against points located with the GPS. As such, the identified earthworks were recorded by local offsets from a 30m hand tape. Localised plans were produced and the location of features was recorded on appropriately scaled mapping. This approach is comparable to an enhanced level 1 landscape survey (English Heritage 2007).	3.2.23
3.2.13	The photographic survey comprised two-levels of recording. The first level recorded the general character and nature of the Site with the second level made consisting of detailed shots of individual features. The detailed shots contained a 1m or 2m scale bar as appropriate. The location of photographs was recorded on appropriately scaled mapping showing the location and direction of shot.	3.2.24
3.2.14	The photographic record comprised digital photographs taken with a digital SLR camera. The photographic record was made in tandem with the measured survey.	3.2.25
3.2.15	The full photographic record, together with copies of the marked up plans and a photo gazetteer will be included in the site archive.	
	Data Processing	
3.2.16	Any measured survey undertaken with the Leica DGPS was exported as both .DBX and .TXT files. This system employs the Smartnet Corrections service and as such provides a real time accuracy with an average plus or minus of 0.02m. The exported data was subsequently processed within Wessex Archaeology's in house software and exported to AutoCAD (AutoCAD map 3D 2011) as a .DWG file.	
3.2.17	This report contains plans showing the location of identified earthworks and features on Ordnance Survey base mapping. Plans and profiles are also included where these enhance the understanding of the feature.	
3.2.18	Selected photographs from the photographic survey have been included within this report, whilst smaller scale copies of the photographs are incorporated within the accompanying gazetteer.	
	Results	
	Introduction	
	The sketch survey has confirmed the presence of the earthwork features identified in the LiDAR survey of the Site (Figure 12) and also shed light on several linear anomalies visible in the LiDAR data but not identified as archaeologically significant in the LiDAR interpretation.	
	A large mound possibly representing a modern industrial dump was recorded (feature 1) as well as the ephemeral remains of southeast to northwest aligned linear (feature 2). Both of these features were captured as part of the topographic survey of the western part of the Site. Within the copse woodland (Plate 4) a large medieval pond (WA7.39) and associated leat was recorded (feature 4).	
	The topographic survey also captured several additional linear features running parallel with Bourne Brook in the southeast most field of the Site (feature 3). These are most likely to be drain cuts.	
	The only features visible in the LiDAR data and not visible on the ground were all situated in the north-western most field (Plate 1). A southwest-northeast aligned linear (feature 5) and a small circular mound (feature 6) are both visible in the LiDAR data but not on the ground due to the tall grass covering most of the pasture (Figure 12). These features were likely to be present based on the accuracy of the LiDAR data elsewhere on Site, however, the thick, tall grass and nettles made their identification impossible. Neither of these features was identified as being archaeologically significant in the LiDAR interpretation.	
	Interpretation: Archaeology	
	Feature 1: A large rectangular mound (WA7.44) centred on NGR 410630, 314147 (Plate 5). The earthwork has steep banks to the north and south (Figure 14) with the western bank rising more gently to a flat top. Copse woodland surrounds the feature to the northwest and southeast with the eastern bank of the earthwork obscured by trees (Plate 2). The mound measures 164m southwest-northeast and 82m northwest-southeast and covers an area of 12,563 square metres. The mound has a maximum height of 3 metres rising from 75.5m aOD at its northeast edge (Plate 6) and 76.5m at its southwest edge to a height of 78.5m at its summit. This would give the mound an approximate volume of 37,689 cubic metres. Given its regularity, the mound has been interpreted as representing a modern dump. A smaller, irregularly shaped spur of dumped material is located 80m to the south of the main mound and immediately to the south of copse woodland which obscures the eastern edge of the earthwork (Figure 12). This spur covers an area of 1,863 square metres and is 2m high at its peak giving an approximate volume of material measuring 3,726 cubic metres. This smaller mound of material trails off at its southern limit to blend with the surrounding pasture at 75.5m aOD. This spur is centred on NGR 410664, 314015.	
	Feature 2: A very ephemeral southeast-northwest aligned depression recorded in the LiDAR interpretation as a possible trackway (WA7.43). The feature is barely visible on the ground with indistinct edges and an ill-defined shape (Figure 12). The depression measures 27m southeast-northwest with a maximum width of 7m and an area of 160 square metres (Plate 7). The feature is approximately 0.15m deep at its base. The feature has no distinct terminus with its southern limit merging with the surrounding pasture.	
	Feature 3: Represented by two southwest-northeast aligned linear anomalies visible in the LiDAR data but not defined as archaeologically significant (Figure 12). The features are visible	

	on the ground as two subtle depressions measuring approximately 1m wide and less than 0.1m deep (Plate 7). The anomalies are aligned with drain covers within an area of pasture at the southeast limit of the Site. It is assumed therefore that they represent backfilled service trenches for drain pipes.	
3.2.26	Feature 4: A large marsh pond with accompanying leat (Plate 9). The feature is identified in the LiDAR interpretation as being one of a series of medieval ponds within the surrounding fields serviced by Bourne Brooke and associated leats (Plate 10). The pond measures approximately 49m south-north and 37m east-west covering an area of 1,826 square metres. The pond has poorly defined marshy edges. The south-north leat which services the pond and connects to Bourne Brooke measures approximately 2m wide and 0.5m deep. Due to the canopy of the dense copse woodland no metric survey was able to be carried out using DGPS.	
3.2.27	Feature 5: A southwest-northeast aligned linear running for 188m across pasture to the north of the Site (Figure 12). The feature wasn't visible on the ground due to the long grass and nettles in the fields. The feature wasn't identified as being archaeologically significant in the LiDAR interpretation. The feature is on the same alignment and the same size as drains recorded as feature 3 to the south. It is likely therefore that this linear represents a modern service.	
3.2.28	Feature 6: A small circular mound seen in the LiDAR data but not recorded as archaeologically significant (Figure 12). The feature was difficult to record on Site due to it being heavily overgrown with nettles. The feature was roughly 8m in diameter. Its origin is uncertain.	
	Conclusions	
	<i>Introduction</i>	
3.2.29	The sketch survey has confirmed the presence of features WA7.44 (feature 1), WA7.43 (feature 2) and WA7.39 (feature 4) recorded in the LiDAR interpretation as being of archaeological significance. These features all survive as earthworks visible on the ground, although feature 2 (a southeast-northwest aligned linear) is very ephemeral. The sketch survey also confirmed the presence of features 3, 5 and 6 which are visible on the LiDAR data but not recorded as being archaeologically significant. The sketch survey has demonstrated that these features are of likely modern origin taking the form of service trenches or dumps of modern material.	
	<i>Discussion</i>	
3.2.30	The topographic survey of the open pasture fields allowed for the identification and accurate measurement (through use of DGPS) of features 1 and 2 which had previously been identified in the LiDAR interpretation. The topographic survey matches up remarkably well with the LiDAR data and has confirmed the size and location of both earthworks.	
3.2.31	Feature 1 (WA7.44) was confirmed to be a large flat topped mound possibly formed by episodes of modern dumping with a connected spur of to the southeast perhaps linking the feature to the modern road. The sketch survey has helped to flesh out the bones of the LiDAR data by adding topographic data regarding the slope of bank and helping to define the exact limits of the earthwork.	
3.2.32	Feature 2 (WA7.43) was only visible on the ground as a very ephemeral southeast-northwest aligned depression. The feature was almost impossible to spot with the naked eye but has proven easier to identify in both the LiDAR data and the topographic survey. It seems likely that this feature is indeed part of a trackway running roughly south-north. Given that the linear	
	doesn't align with any of the modern field system it seems likely that the feature dates to a pre medieval time frame.	
3.2.33	Several southwest-northeast aligned linears are visible in the LiDAR data but not recorded as being archaeologically significant (features 3 and 5). The topographic survey of these features has confirmed their presence and identified their function as being modern drains.	
3.2.34	Within the copse woodland it wasn't possible to take accurate measured survey due to the tree canopy. However, the sketch survey has still succeeded in identifying the presence of pond (WA7.39) and an associated leat (feature 4).	
3.2.35	This pond is likely to be Medieval in origin and served to irrigate the surrounding field system in conjunction with Bourne Brooke and several other similar ponds in surrounding fields. This system was all inter The sketch survey has highlighted the accuracy of the LiDAR survey even under the canopy of a dense woodland. All of the features identified in the LiDAR interpretation were present on the ground. The only additional earthwork features identified in the sketch survey were visible in the LiDAR data but not specifically highlighted as significant in the LiDAR interpretation. Visibility was problematic in the northern half of the Site due to tall grass and nettles but given the accuracy of the LiDAR data elsewhere on Site it seems likely that the absence of identifiable features is an accurate reflection of conditions on the ground. A follow up visit in winter with reduced vegetation would confirm this.	

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- Wessex Archaeology (2012), *LiDAR analysis: Community Forum Area 5 (Curdworth to Middleton)*.
- Wessex Archaeology (2013), *HS2 Method Statement for Field Survey*. Report reference 86254.

Table 3: Gazetteer of identified features

Feature ID	Description	NGR	
1	Large mound made up of modern industrial waste. The mound covers an area of approximately 12563 square metres and measures 164m by 82m	410662, 314218 to 410663, 313979	

Feature ID	Description	NGR	
2	Poorly defined southeast –northwest aligned linear. A possible trackway of unknown date. A maximum width of 7m with a maximum depth of 0.15m	410762, 314108	
3	Two modern drain cuts.	410745, 314042 And 410743, 314060	
4	Large Medieval/Post medieval pond measuring 49m by 37m	410746, 314188	

Figures

Figure 12: Site location with LiDAR data



Figure 13: Site plan showing topographic survey overlain on LiDAR data

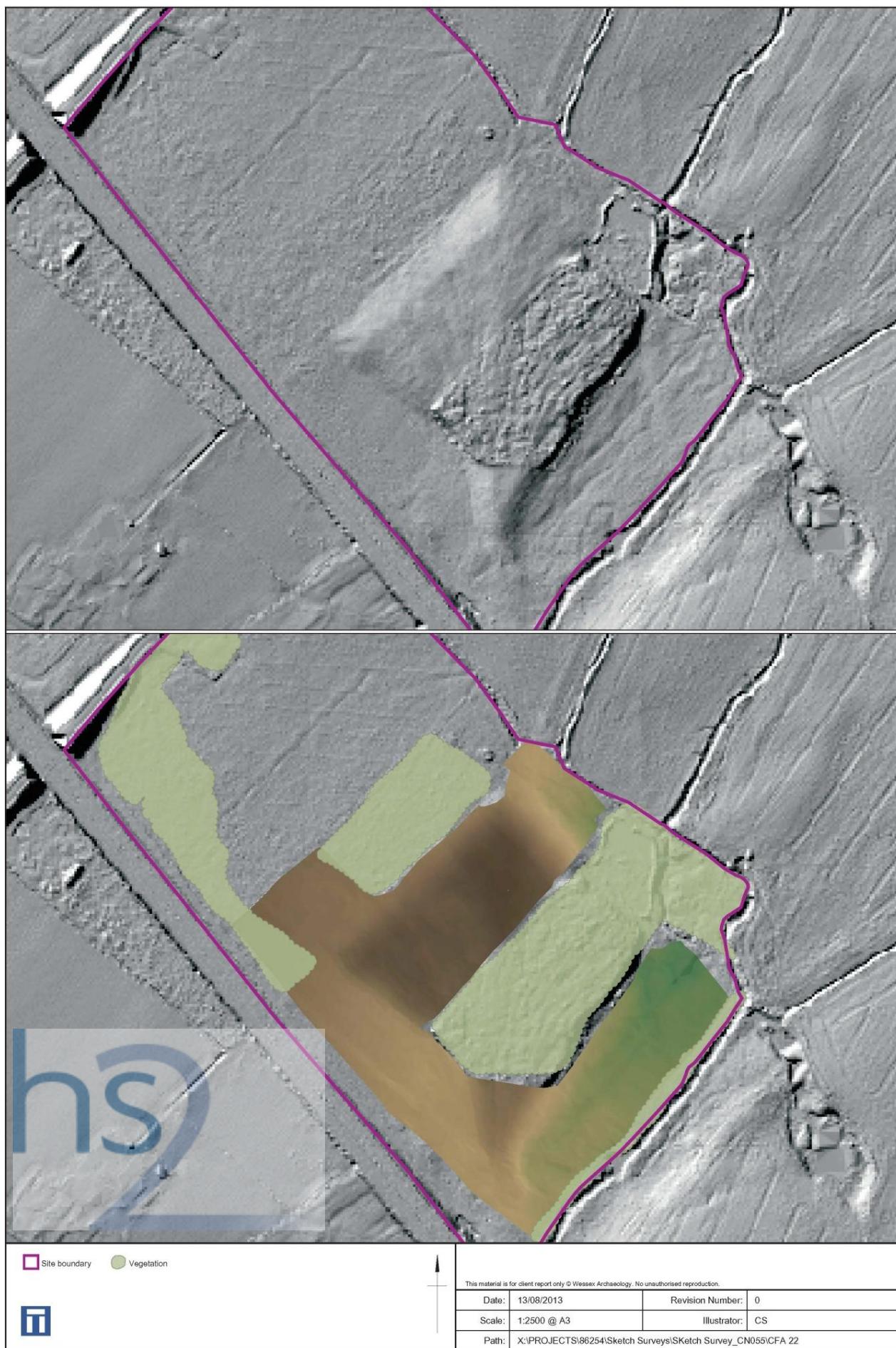


Figure 14: Plan of topographic survey of features 1 and 2 with contour information



Plates



Plate 1: General shot of pasture at northwest end of site, facing south



Plate 3: General shot of pasture at southeast end of site, facing south



Plate 2: Feature 1. General shot of raised mound, facing northeast



Plate 4: General shot of woodland containing marsh pond (feature 4), facing east



Plate 5: Feature 1, southern bank of mound. Facing north



Plate 7: Feature 2, subtle depression forming southeast-northwest aligned linear, facing south



Plate 6: Feature 1, northern bank of mound. Facing southeast



Plate 8: Feature 3, depression formed by drain cut. Facing northeast



Plate 9: Feature 4, general shot of pond at northeast end of Site. Looking south



Plate 10: General shot of leat servicing pond 4, facing north

4 Geophysical surveys

CNo44 Land near Lichfield, Staffordshire

Introduction

Project Background

4.1.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNo44 on agricultural land, near Lichfield, Staffordshire (Figure 15), hereafter “the Site” (centred on NGR 414400 309475). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.1.2 This Site, CNo44, was selected for geophysical survey as it is close to known archaeological remains. It is considered to be an area at medium risk (risk model score: 3).

Site details

4.1.3 The Site comprises two arable fields located off Cappers Lane (A5192) with a railway running along the northern edge of the survey area. The Site lies approximately 2.9km east of the centre of Lichfield and 21.7km NNE of the centre of Birmingham. The limits of the geophysical survey area are defined by field boundaries with the northern limits defined by a railway that passes along here. Geophysical survey was undertaken over all accessible areas of the Site with a small area lost to obstructions. The area of data coverage came to around 11.2ha.

4.1.4 The Site lies on an area of gently sloping land that slopes downwards towards the north; the land lies at a height around 70m aOD (above Ordnance Datum) at the south and drops to around 65m aOD at the north. A small stream flows from the northeast corner of the western field, a tributary of Mare Brook. The brook flows northeast across the Coventry Canal and into the River Tame.

4.1.5 The solid geology is recorded as sandstone (Triassic); mudstone of the same date is recorded close by (Ordnance Survey 1957). No superficial deposits are recorded on Site. The soils underlying most of the Site are likely to be typical brown earths of the 541b (Bromsgrove) association; deposits of typical stagnogley soils of the 711b (Brockhurst 1) association are located in the northeast corner of the Site (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

4.1.6 There are no records of archaeological sites within the survey area. Sites located within 1km of the survey area will be discussed; for a full account of the recorded heritage assets the appropriate Desk-Based Assessment (DBA) should be consulted.

4.1.7 There are no records of Palaeolithic, Mesolithic or Iron Age sites or findspots within 1km of the survey area. A probable late Neolithic or Bronze Age ring ditch was identified from Aerial Photographs (APs) to the northeast of the survey area (MST2082). Another cropmark is located to the north of this one of unknown date with a rectilinear form (MST2081).

4.1.8 A late 2nd century silver coin, a sestertius of Julia Domna was found to the south of the survey area (MST3684). Three more Roman coins were found to the west of the survey area in 1969 ranging in date from 222AD to 340AD (MST3395). A line of the Ryknild Street Roman road is

4.1.9 recorded to the northwest, a ditch was found in this area on a similar alignment although the ditch is considered to be post-medieval upon excavation (MST13368). No post-Roman or Anglo-Saxon records are located within 1km of the survey area.

4.1.10 Two sides of a probable medieval moat were identified as cropmarks to the north of the survey area (MST2071). A late 13th century penny of Edward I was found with a metal detector to the south of the survey area (MST3684). A medieval copper-alloy buckle in good condition was found with a metal detector to the north of the survey area (MST16156).

4.1.11 A section of the Wyrley and Essington canal extension lies to the south of the survey area; it was authorised in 1794 and links up with the Coventry Canal further east (MST4775). There are likely to be many other installations and features associated with this canal but the relevant DBA should be consulted for further details of all these. A possible site of a watermill is located to the southeast of the survey area, south of the canal extension. The mill is supposed to be located in this area based on cartographic evidence and may be post-medieval or earlier in date (MST3500). Another mill is thought to be located to the southwest of the survey area from the same cartographic evidence (MST3501). A number of listed buildings are located within 1km of the survey area; the relevant DBA should be consulted for further detail concerning these.

4.1.12 A Second World War or later Ministry of Agriculture, Fisheries and Food (MAFF) strategic food store/buffer depot is located to the northwest of the survey area (EH588a).

Methodology

Survey Objectives

4.1.13 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

4.1.14 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

4.1.15 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 10th and 14th June 2013.

Grid Location

4.1.16 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

4.1.17 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual

	inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.	
	Instruments Used and Survey Method	
4.1.17	The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).	4.1.26
4.1.18	Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.	4.1.27
	Data Processing	
4.1.19	Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 8\text{nT}$ thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The deslope function was used to correct errors that resulted from imperfections in the ZMT function caused by areas of dense ferrous responses. These three steps were applied to all survey data, with no interpolation applied.	4.1.28
4.1.20	Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.	4.1.29
	Data Presentation	4.1.30
4.1.21	The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).	4.1.31
4.1.22	The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1250.	4.1.32
	Results	4.1.33
	Introduction	
4.1.23	The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and two modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1250 (Figures 15-21).	4.1.34
4.1.24	The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 18 and 21). Full definitions of the interpretation terms used in this report are provided in Appendix 2.	4.1.35
4.1.25	Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.	
	Interpretation: Archaeology	
	The western field is dominated by ferrous responses; these anomalies are very strong and will obscure any archaeological features that may be present here. The only areas where archaeological features may be observed are the relatively sparse areas of the field where the spread of ferrous is not continuous. The only anomaly of likely archaeological interest in this field is a small sub-oval positive anomaly at 4000; it measures 2.3m in length and has magnetic values over 3nT. This anomaly is classed as archaeology and is considered to represent a cut feature such as a pit.	
	There are other positive anomalies in this field such as at 4001 but they are not as clear as the larger example at 4001. These anomalies have positive values but could represent spikes in the data, ferrous responses or small archaeological features; these anomalies have been classed as possible archaeology due to the uncertainty in their interpretation.	
	There are a couple of trends visible in the quiet areas of this field; the example at 4002 may prove to be archaeological and has been classed as uncertain origin whereas the example at 4003 is clearly a ploughing trend.	
	There are two parallel services at 4004; these will be discussed in greater detail in the section below.	
	The eastern field contrasts greatly with the western field in that there are far fewer ferrous anomalies present in the data. There are a few anomalies of likely archaeological interest and the most interesting of these is 4005; this anomaly is a short weak linear with one stronger region. The linear measures at least 10.7m in length and has magnetic values less than +2nT for most of the anomaly with a stronger region with values over +3nT. This anomaly is classed as archaeology and is considered to represent a cut feature such as a ditch.	
	There are two smaller sub-oval shaped positive anomalies at 4006 and 4007; they both measure around 1.8m in length and have magnetic values over +3nT. These anomalies are considered to represent pits and are classed as archaeology.	
	There is a long curvilinear anomaly at 4008; it has very weak magnetic values less than +1nT and has a rather irregular form. The feature is classed as possible archaeology (weak response) because it has weak values and it is also located close to clear geological responses and may also prove to be geological. If this feature proves to be archaeological it may represent a ditch with a fairly sterile fill. Another similar anomaly is located further to the northwest.	
	There are numerous linear arrangements of bipolar anomalies (black and white) that are considered to represent ceramic field drains. The majority of these drains are arranged in a herringbone pattern, as seen around 4009, although there are other drains that do not fit with this overall pattern. In addition to these field drains are a number of ploughing trends scattered throughout the data such as those around 4010.	
	There are other trends present in the data that may prove to be archaeological such as the peculiar arrangement of weak positive linear trends at 4011 and the curvilinear trend at 4012. In addition to these trends there are numerous small positive anomalies; they vary in strength from less than +1nT to over +3nT and may prove to be archaeological. They have been classed as possible archaeology as there is no significant patterning in their spatial distribution.	
	There is a large ferrous response at 4013; this is a base of a pylon that carries overhead cables across the field, roughly southwest to northeast.	

- 4.1.36 There are several spreads of increased magnetic response around the edges of the fields such as at 4014; most of these may prove to be spreads of relatively modern ceramic/ferrous debris but some spreads could prove to be spreads of magnetically enhanced archaeological debris.
- 4.1.37 The last group of anomalies present are broad diffuse areas of bipolar responses such as at 4015 and 4016. They have typical magnetic values between -2nT and +2nT and are considered to represent geological responses and have been classed as natural.
- Interpretation: Modern Services**
- 4.1.38 Two modern services have been identified in the data close to 4004; it is unclear whether these services represent pipes or cables. They are set roughly parallel to one another, aligned roughly southeast to northwest. The services end at the beginning of an unnamed brook to the east and run beyond the extents of the survey area to the west.
- 4.1.39 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.
- Conclusions**
- Introduction**
- 4.1.40 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response and numerous trends of uncertain origin. At least two modern services were detected. Very little beyond ferrous responses were identified in the western field.
- Discussion**
- 4.1.41 The western field is dominated by ferrous responses and the geophysical survey is considered to have not fulfilled the objectives of the survey. This is due to the fact that the wide spreads of ferrous in this field will have prevented the detection of archaeological features that may be present here. This ferrous may have been added along with other organic material used to manure the fields or may simply represent rubbish ploughed into the field to disperse it. The eastern field by contrast is relatively clear of ferrous responses and the survey is considered to have been successful here.
- 4.1.42 Only a few pit-like anomalies and one linear ditch-like anomaly was identified in the data, the rest of the anomalies are either less likely to be archaeological or are clearly modern or geological. There are no wide spreads of concentrated archaeological features visible in the data to suggest the presence of any settlement in these fields.
- 4.1.43 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.
- 4.1.44 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more

archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

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- Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.
- Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.
- Wessex Archaeology (2013), HS2: *Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER Records Consulted

- MST2071 – Possible moat, west of Fulfen Wood, Streethay.
- MST2081 – Enclosure, Thatchmoor, Whittington.
- MST2082 – Ring Ditch, Whittington.
- MST3395 – Roman Coins, Ash Grove, Lichfield.
- MST3500 – Watermill, Lichfield.
- MST3501 – Watermill, Lichfield.
- MST3684 – Coin findspot, Whittington.
- MST4775 – Lichfield Canal, Wyrley and Essington Extension.
- MST13368 – Ditch, Shaw Lane, Streethay.
- MST16156 – Buckle findspot, Lichfield.

English Heritage PastScape Records

- Buffer Depot 588a (EH588a).

Figures

Figure 15: Site location

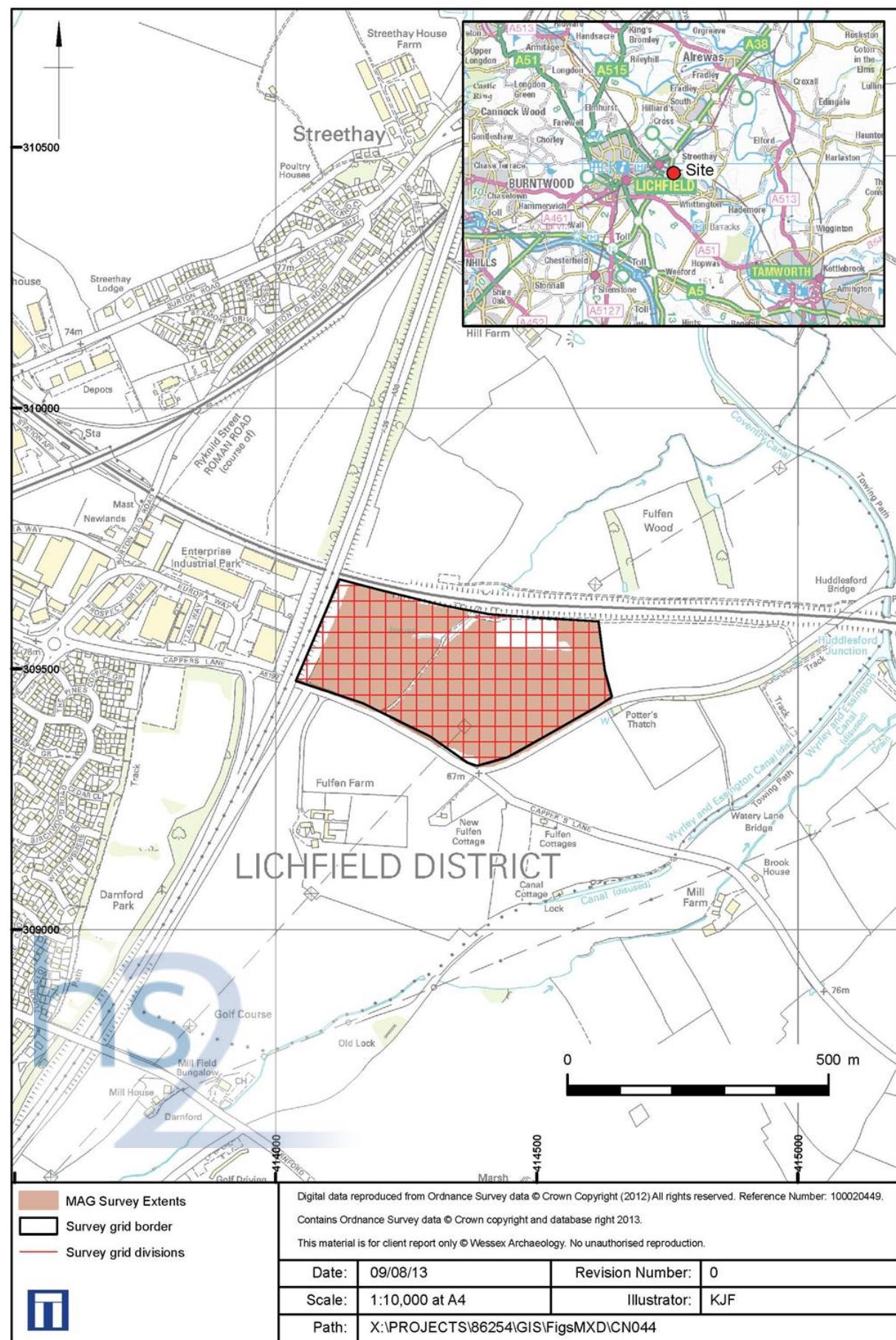


Figure 16: Greyscale plot: North-west

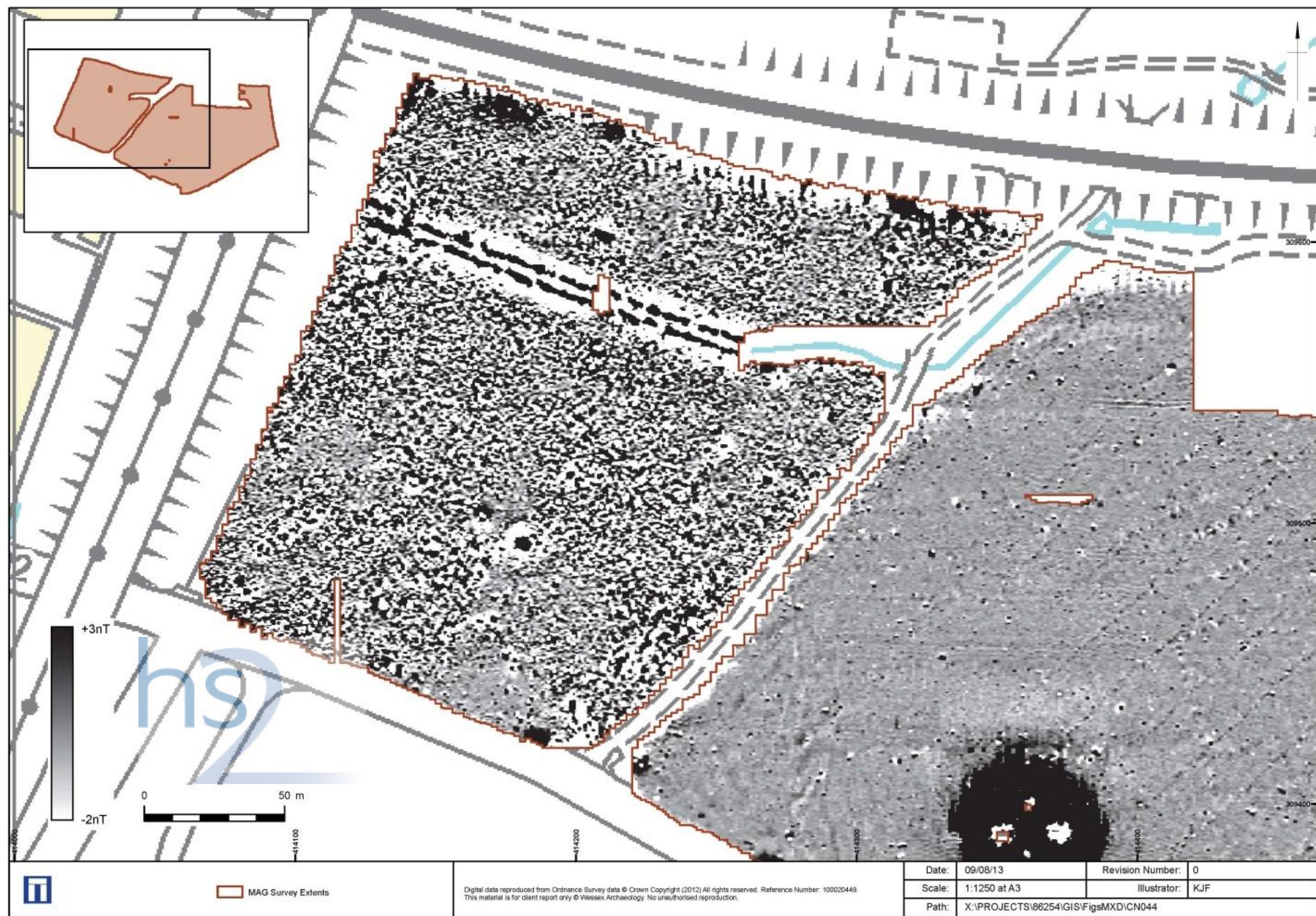


Figure 17: XY trace: North-west

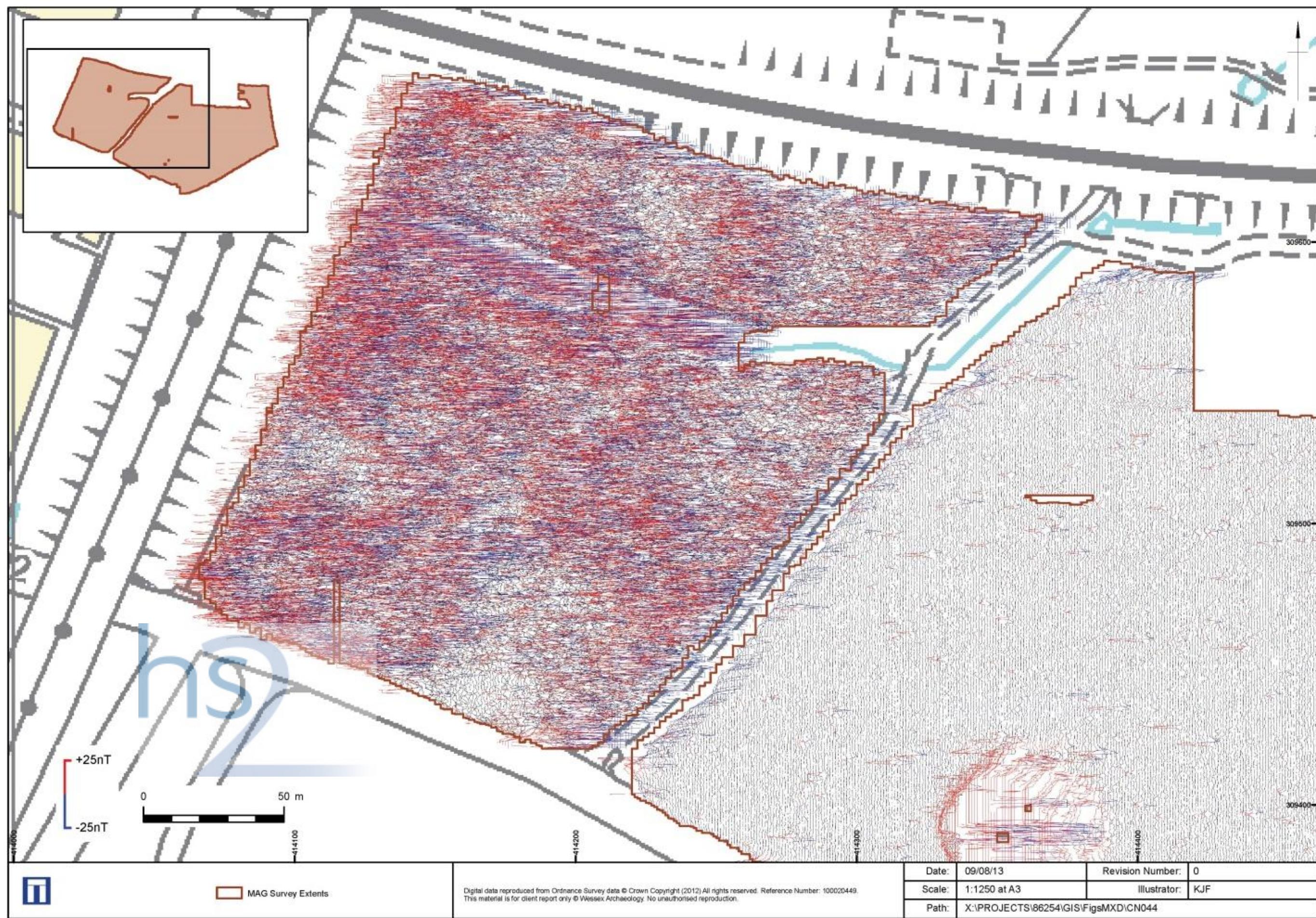


Figure 18: Interpretation: North-west

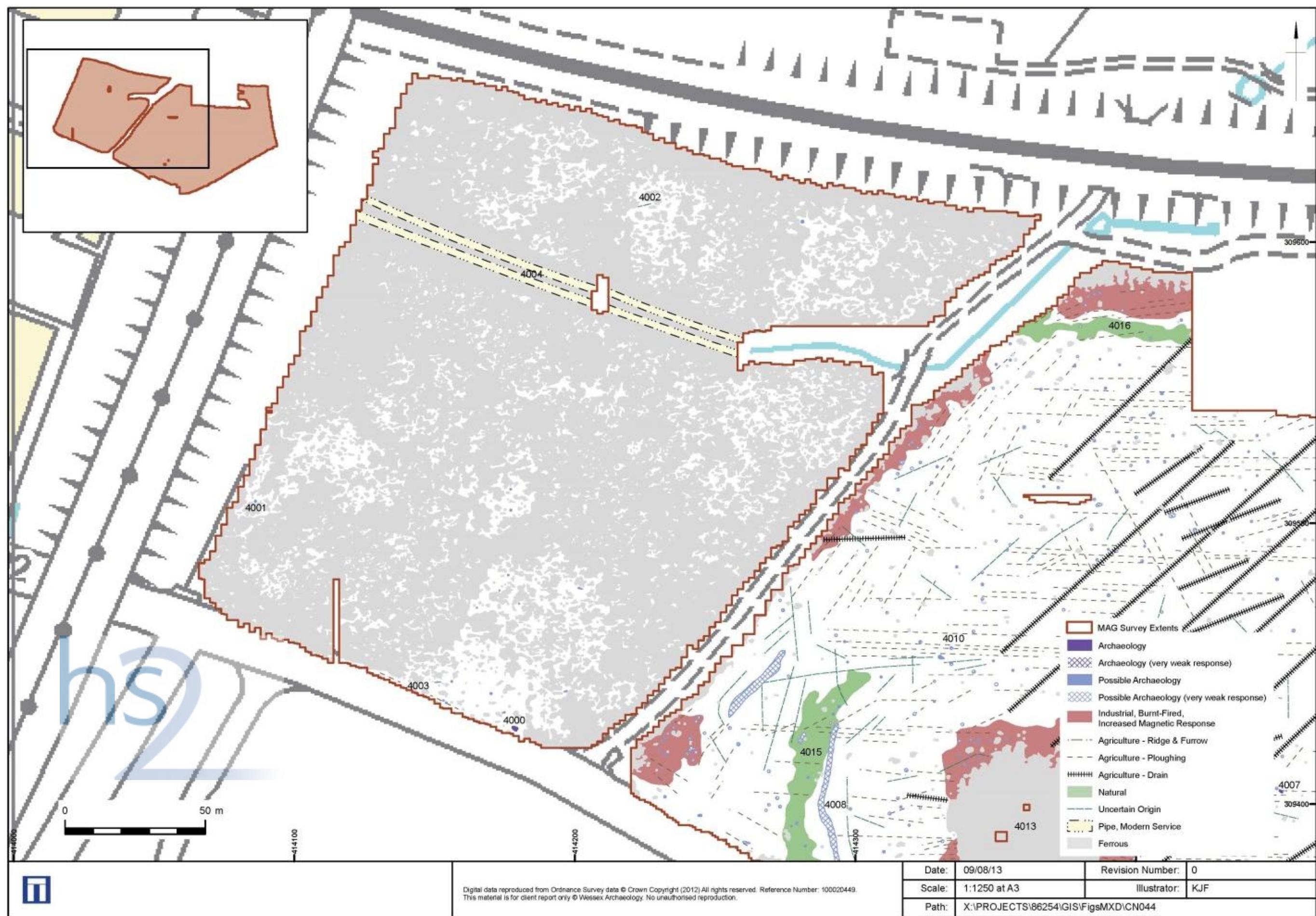


Figure 19: Greyscale plot: South-east

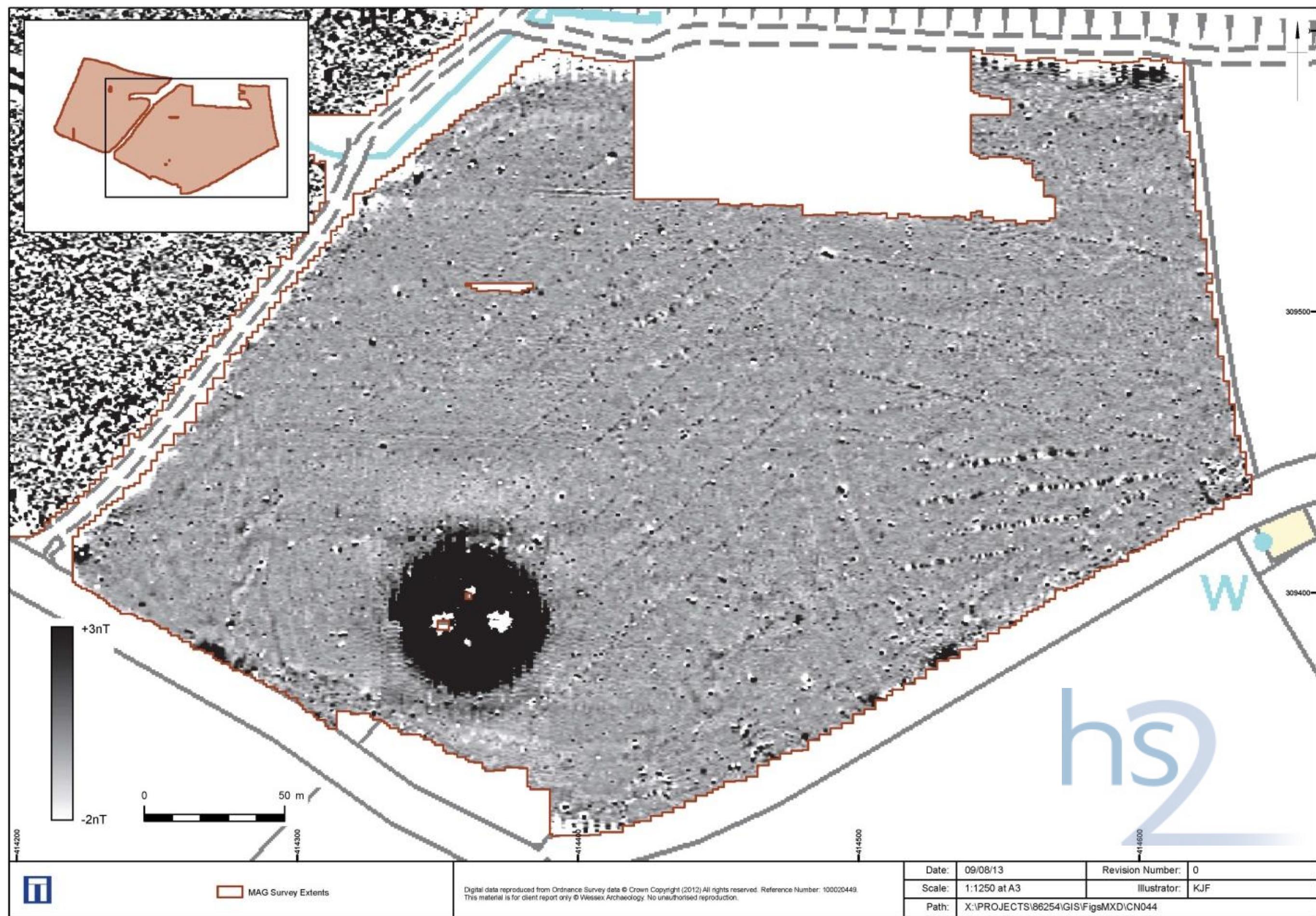


Figure 20: XY trace: South-east

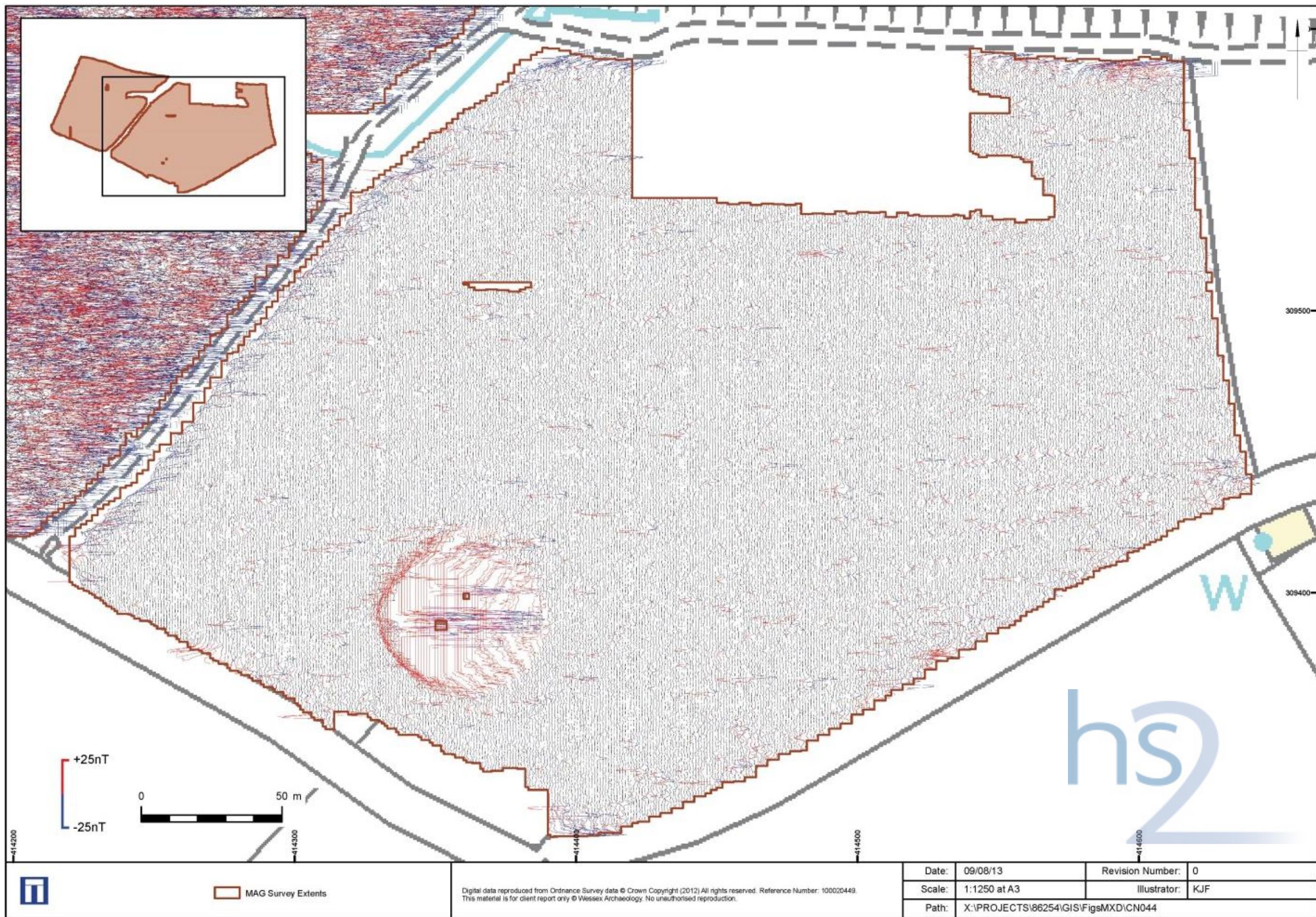
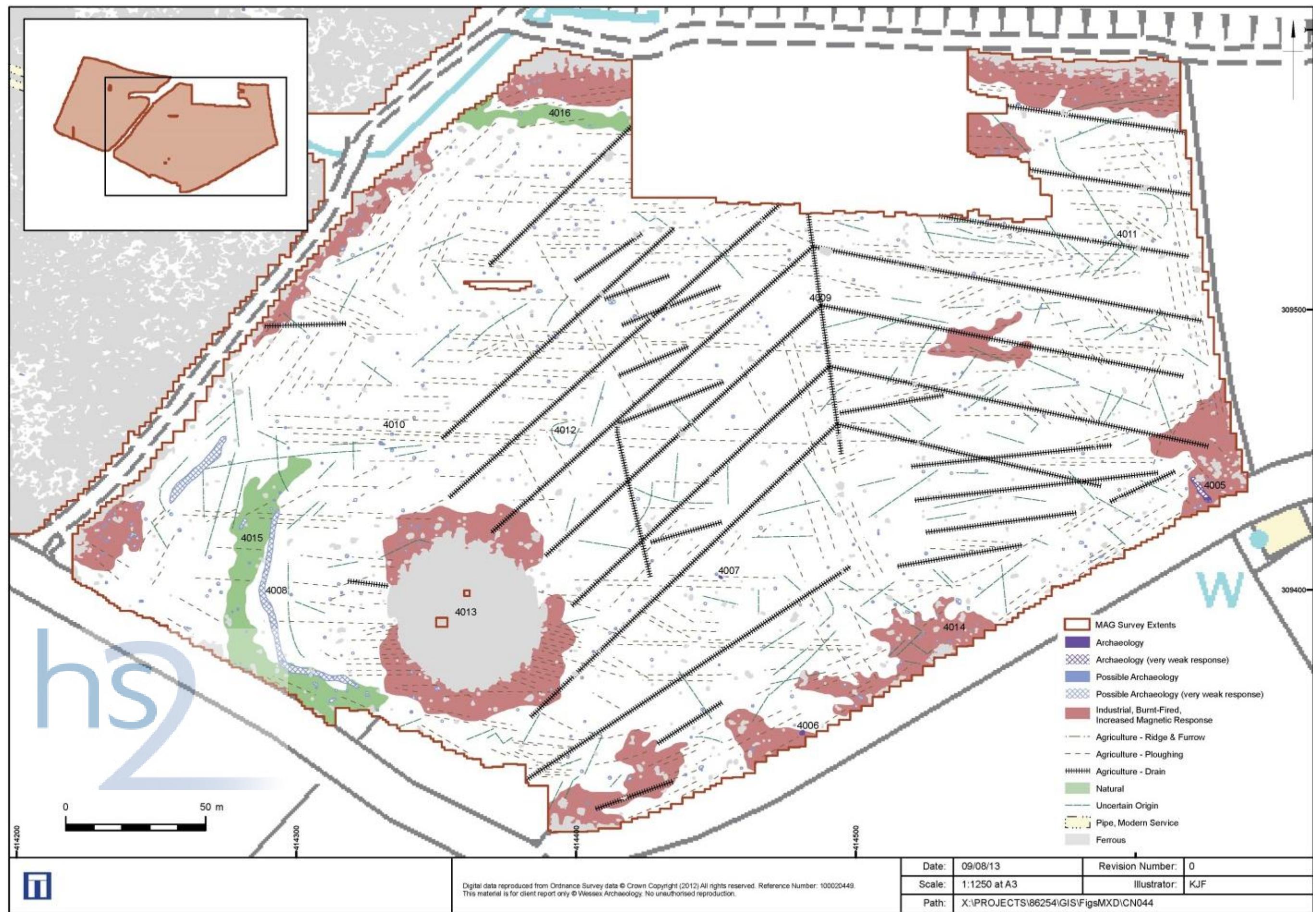


Figure 21: Interpretation: South-east



4.2 CNo45 Land near Lichfield, Staffordshire.

Introduction

Project Background

4.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNo45 on agricultural land, near Lichfield, Staffordshire (Figure 22), hereafter "the Site" (centred on NGR 414720 309990). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.2.2 This Site, CNo45, was selected for geophysical survey as it is close to known archaeological remains. It is considered to be an area at medium risk (risk model score: 2).

4.2.3 The fieldwork was directed by Ross Lefort and assisted by Phil Roberts, Chris Breeden, Charlie Hay, and Jonathan Butterly. Genevieve Shaw processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston and Dr. Paul Baggaley. Illustrations were prepared by Kitty Foster. The project was managed on behalf of Wessex Archaeology by Nicholas Cooke.

Site details

4.2.4 The Site comprises two arable fields located off Cappers Lane (A5192) with a railway running along the southern edge of the survey area. The Site lies approximately 3km east of the centre of Lichfield. The limits of the geophysical survey area are defined by field boundaries to the north and west, the Coventry Canal to the east and a railway to the south. Geophysical survey was undertaken over the southern half of the Site as there were access issues with livestock in the northern half. The area of data coverage came to around 7ha.

4.2.5 The Site lies on an area of gently sloping land that slopes downwards towards the south; the land lies at a height around 75m aOD (above Ordnance Datum) at the north and drops to around 65m aOD at the south.

4.2.6 The solid geology is recorded as sandstone (Triassic); mudstone of the same date is recorded close by (Ordnance Survey 1957). No superficial deposits are recorded on Site.

4.2.7 The soils underlying most of the Site are likely to be typical brown earths of the 541b (Bromsgrove) association; deposits of typical stagnogley soils of the 711b (Brockhurst 1) association are located in the northeast corner of the Site (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

4.2.8 For a detailed assessment of the known archaeology of the Site and surrounding area the relevant DBA should be consulted. A summary of the available archaeological records has been provided here for reference with the results and interpretation of the geophysical survey.

4.2.9 There are no records of archaeological sites within the survey area. Sites located within 1km of the survey area will be discussed; for a full account of the recorded heritage assets the appropriate Desk-Based Assessment (DBA) should be consulted.

4.2.10 There are no records of Palaeolithic, Mesolithic or Iron Age sites or findspots within 1km of the survey area. A probable late Neolithic or Bronze Age ring ditch was identified from Aerial

Photographs (APs) to the northeast of the survey area (MST2082). Another cropmark is located to the north of this one of unknown date with a rectilinear form (MST2081).

4.2.11 A late 2nd century silver sestertius coin of Julia Domna was found to the south of the survey area (MST3684). Three more Roman coins were found to the west of the survey area in 1969 ranging in date from 222AD to 340AD (MST3395). A line of the Ryknild Street Roman road is recorded to the northwest, a ditch was found in this area on a similar alignment although the ditch is considered to be post-medieval upon excavation (MST13368). No post-Roman or Anglo-Saxon records are located within 1km of the survey area.

4.2.12 Two sides of a probable medieval moat were identified as cropmarks to the west of the survey area (MST2071). A late 13th century penny of Edward I was found with a metal detector to the south of the survey area (MST3684). A medieval copper-alloy buckle in good condition was found with a metal detector to the north of the survey area (MST16156).

4.2.13 A section of the Wyrley and Essington canal extension lies to the south of the survey area; it was authorised in 1794 and links up with the Coventry Canal further east (MST4775). There are likely to be many other installations and features associated with this canal but the relevant DBA should be consulted for further details of all these. A possible site of a watermill is located to the southeast of the survey area, south of the canal extension. The mill is supposed to be located in this area based on cartographic evidence and may be post-medieval or earlier in date (MST3500). Another mill is thought to be located to the southwest of the survey area from the same cartographic evidence (MST3501). A number of listed buildings are located within 1km of the survey area; the relevant DBA should be consulted for further detail concerning these.

4.2.14 A Second World War or later Ministry of Agriculture, Fisheries and Food (MAFF) strategic food store/buffer depot is located to the northwest of the survey area (EH588a).

Methodology

Survey Objectives

4.2.15 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

4.2.16 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

4.2.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team from 11-12 June 2013.

	<i>Grid Location</i>	
4.2.18	The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).	4.2.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 25). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
4.2.19	A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.	4.2.28 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
	<i>Instruments Used and Survey Method</i>	<i>Interpretation: Archaeology</i>
4.2.20	The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).	4.2.29 The greatest concentration of possible archaeological anomalies is across the northern part of the Site due to background noise from the railway obscuring potential anomalies to the south. At 4000 are two curvilinear positive anomalies probably cut features which both have an area of ferrous at the same end. Approximately parallel to these positive anomalies is a third curvilinear area of dipolar anomalies interpreted as ferrous. The positive anomalies at 4000 have been characterised as archaeology but the ferrous curvilinear area should also potentially be considered associated. From the morphology or presence of cut features and ferrous it cannot be characterised further at this stage what these might represent. To the west of 4000 is a small, oval discrete positive anomaly which could be a cut feature such as a pit, it has been interpreted as archaeology (weak response).
4.2.21	Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.	4.2.30 Anomalies 4001-4003 and 4005 are all positive linear and curvilinear anomalies that are considered to represent ditches or cut features and have been classed as archaeology (weak response) and possible archaeology. They typically have very weak magnetic values less than +2nT. They do not form a regular or obvious enclosure or large feature but they could hint at this area of the Site having a greater potential for archaeological features. Anomalies 4001-4003 are within an area that has a lower concentration of ferrous anomalies and there are several negative linear trends running across the site of uncertain origin.
4.2.22	<i>Data Processing</i> Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 7\text{nT}$ thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.	4.2.31 This area also seems to be bounded by 4007 which is a large and broad curvilinear feature with a length of approximately 150m. It's not known whether this is the true size of the feature as at either end it is cut off by the railway line and interference from an overhead electricity cable. It is a weakly positive anomaly with an outer weakly negative curvilinear associated. It has been classified as natural but as mentioned before it does seem to bound the area around 4001-4003 and therefore could have been a natural feature possibly modified for use.
4.2.23	Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.	4.2.32 At 4004 and 4006 are further several small oval, sub-oval and curvilinear positive anomalies that could represent cut features such as pits, postholes and sections of ditches. They have been classified as possible archaeology with a number of them as having a weak response.
4.2.24	<i>Data Presentation</i> The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).	4.2.33 There are several ceramic field drains present at 4000 and to the south of 4006. They are of differing orientations.
4.2.25	The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.	4.2.34 The area to the south of 4007 contains few anomalies of interest aside from small discrete positive anomalies that have been classified as possible archaeology; they do not form a significant pattern or concentration.
	<i>Results</i>	
	<i>Introduction</i>	
4.2.26	The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 23 to 25).	4.2.35 To the north-west of 4001 is a large area of increased magnetic response and containing numerous ferrous anomalies; no anomalies of archaeological interest have been identified within this area.

Interpretation: Modern Services

- 4.2.36 No modern services have been identified but a pipe has been identified north of 4002 running north-east to southwest and terminating in an area of ferrous.

Conclusions

Introduction

- 4.2.37 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response, numerous trends of uncertain origin and agricultural field drains. The response from the railway line to the South will have obscured further anomalies which potentially are of archaeological origin.

Discussion

- 4.2.38 One area to the north-west of the Site at 4000 has detected archaeology in the form of two features interpreted as possibly ditches but they have areas of ferrous associated with them and therefore this cannot rule out a modern origin.

- 4.2.39 The data shows a number of possible archaeological features that have been interpreted as cut features such as pits, postholes and ditches. The anomalies labelled 4001 to 4006 are considered to be the most significant of these. In addition there are a number of similar anomalies spread across the site but that do not form any significant concentration.

- 4.2.40 The large number of anomalies which have been characterised as weak response could hint that there is a low contrast in the soils in this area and therefore it is difficult to detect and identify archaeology such as pits and ditches where the fill is weakly magnetised. The ditch at Shaw Lane was described from excavation as poorly defined with the fill being of successive layers of silty clay and therefore this could be one possibility why features have not sufficient enough contrast to detect them.

- 4.2.41 The large feature at 4007 is tentative and has been classified as natural to err on the side of caution, it could potentially have been used to enclose or bound the area around 4001 to 4003.

References

Bibliography

English Heritage (2008), *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No. 1, 2nd Edition.

Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.

Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.

Wessex Archaeology (2013), *HS2: Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER Records Consulted

- MST 3322 Manor House, moated site.
- MST 14592 Streethay House Farm, built farmstead.
- MST 2071 Possible moat, west of Fulfen Wood.
- MST 14759 Findspot, two coins of Edward I.
- MST 3026 Huddlesford Bridge.
- MST 3025 Huddlesford Junction.
- MST 13368 Ditch, Shaw Lane.
- MST 13307 Plunge Bath, The Manor Place.
- MST 9281 Streethay House Farmhouse, Ryknild Street.
- MST 3500 Watermill, Lichfield.
- MST 3027 Stoney Step Bridge.
- MST 3028 King's Orchard Bridge.
- MST 3024 Bowman's Bridge.
- MST 14761 Findspot, Bow Brooch.
- MST 2082 Ring Ditch, Whittington.
- MST 2081 Enclosure, Thatchmore, Date unknown.
- MST 9292 Huddlesford Grange.
- MST 9236 Canal Milepost.
- MST 9282 The Manor Place.
- MST 16156 Findspot of a medieval buckle.
- MST 9238 Cedar House, Georgian.

Figures

Figure 22: Site location

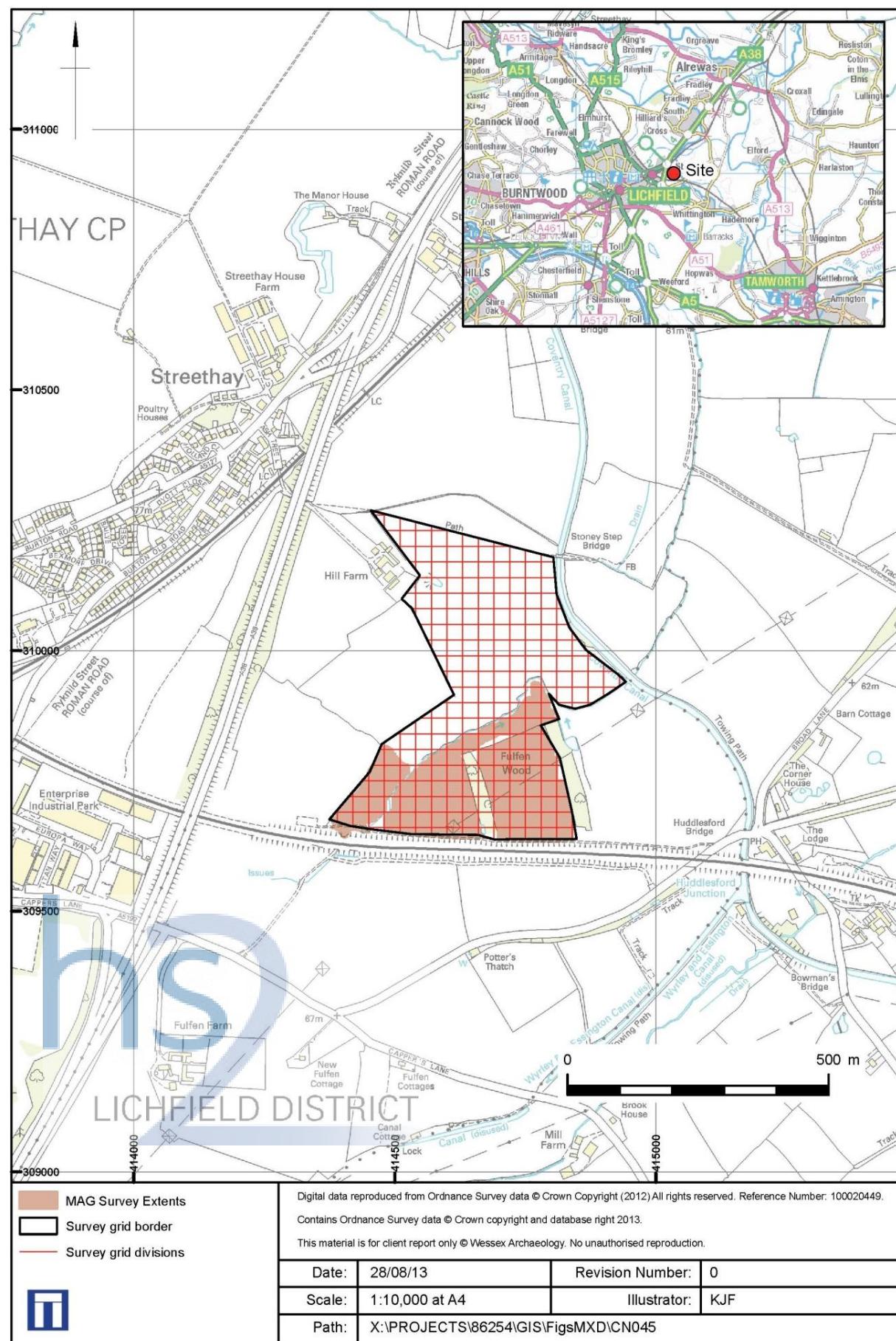


Figure 23: Greyscale plot

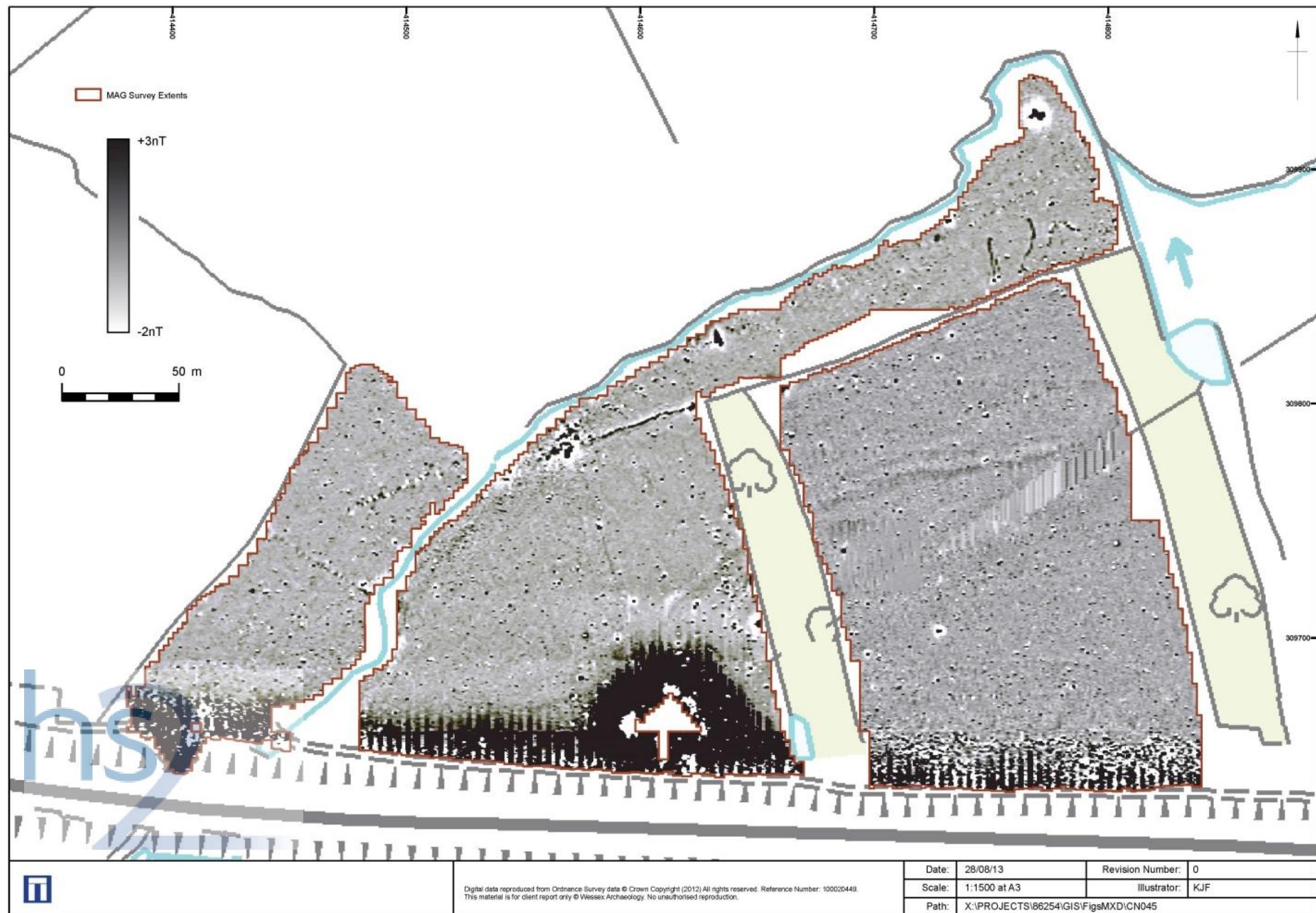


Figure 24: XY trace

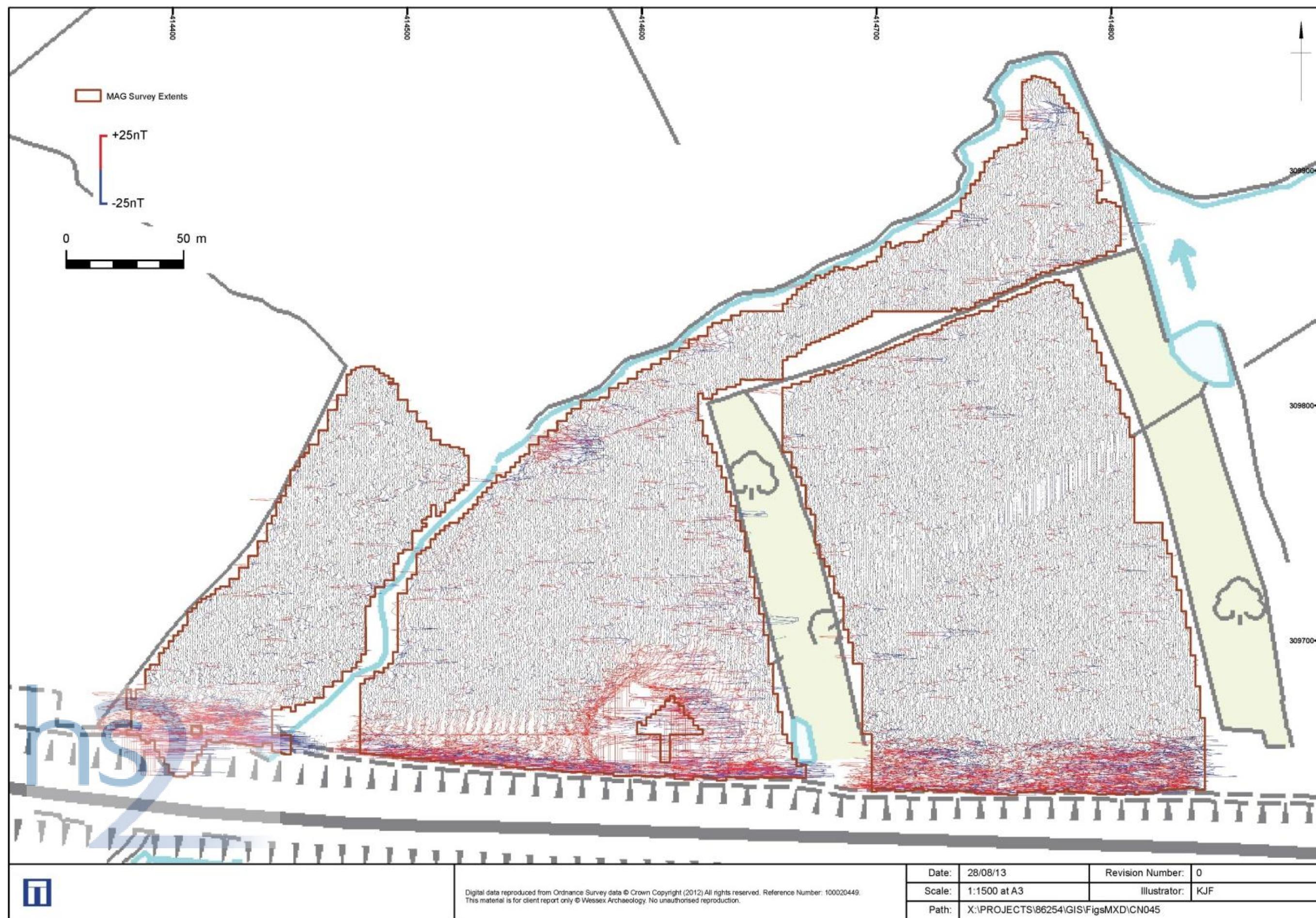
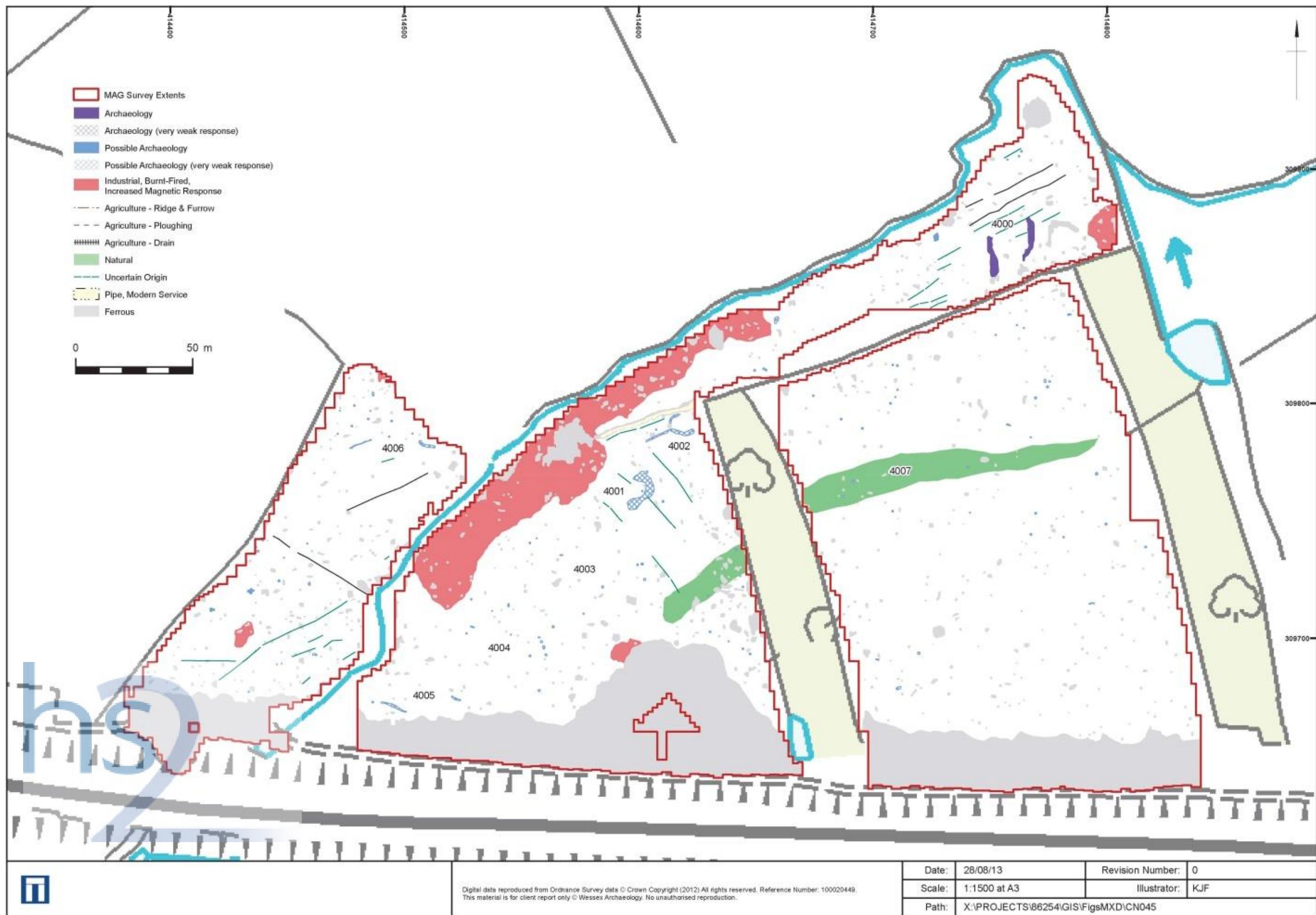


Figure 25: Interpretation



4.3 CNo48 Land near Fradley, Staffordshire.

Introduction

Project Background

- 4.3.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNo48 on agricultural land, near Fradley, Staffordshire (Figure 26), hereafter "the Site" (centred on NGR 413150 313600). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.
- 4.3.2 This Site, CNo48, was selected for geophysical survey as it is close to known archaeological remains. It is considered to be an area at high risk (risk model score: 2).
- 4.3.3 The fieldwork was directed by Alistair Black and assisted by Chris Hirst, Jonathan Buttery and Phil Roberts. Ross Lefort processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston and Dr. Paul Baggaley. Illustrations were prepared by Kitty Foster and Ken Lymer. The project was managed on behalf of Wessex Archaeology by Nicholas Cooke.
- Site details*
- 4.3.4 The Site comprises one arable field located off an unnamed farm track near a place marked "Cranberry" on Ordnance Survey (OS) mapping. The Site lies approximately 2.85km west of the centre of Fradley and 4.6km NNE of the centre of Lichfield. The limits of the geophysical survey area are defined by field boundaries with the southern limits partly defined by the Trent and Mersey Canal that passes along here. The Site comprises one arable field that was under a young/maturing cereal crop at the time the survey was undertaken. Geophysical survey was undertaken over all areas of the Site with only a very small area lost to field boundaries and small obstructions. The area of data coverage came to around 13.4ha.
- 4.3.5 The Site lies on an area of relatively flat land at a height around 65m aOD (above Ordnance Datum). Apart from the manmade watercourse of the Trent and Mersey Canal there are only two natural watercourses close to Site. These brooks are named Curborough Brook and Full Brook that converge south of the site to become Pyford Brook which flows north along the western field boundary before flowing into the River Trent, close to its confluence with the River Swarbourne.
- 4.3.6 The solid geology is recorded as Keuper marl and is likely to be composed of mudstone (Triassic) (Ordnance Survey 1957). The superficial deposits recorded on Site are river terrace deposits (mainly sand and gravel) that were formed in the Quaternary. There are likely to be alluvial deposits close to the brook that flows along the edge of the Site and glacial deposits are recorded nearby (Ordnance Survey 1977).
- 4.3.7 The soils underlying the southern half of the Site are likely to be typical sandy gley soils of the 821b (Blackwood) association and the soils under the northern half are likely to be typical brown sands of the 551d (Newport 1) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

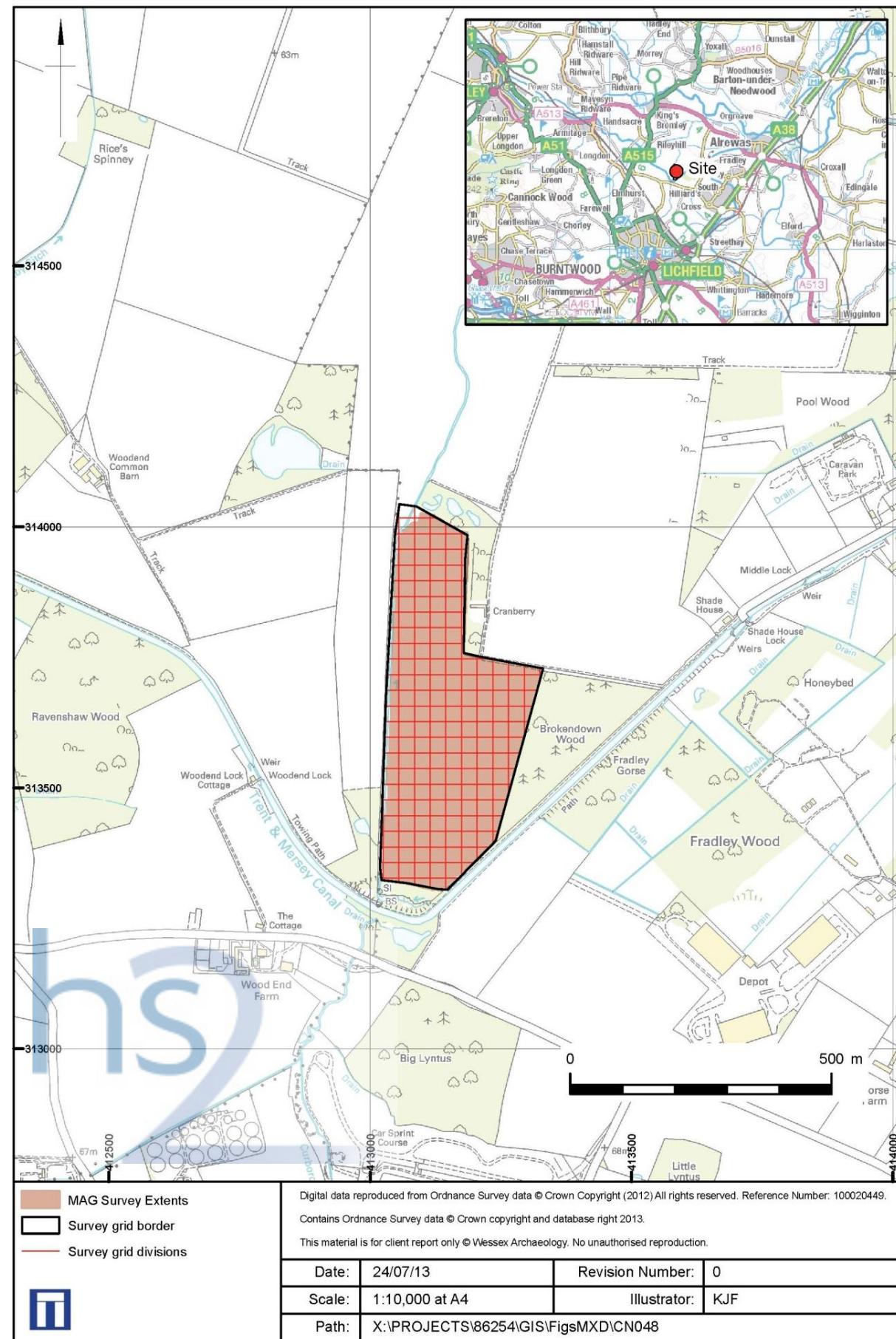
- 4.3.8 There are no records of archaeological sites within the survey area. Sites located within 1km of the survey area will be discussed; for a full account of the recorded heritage assets the appropriate Desk-Based Assessment (DBA) should be consulted.
- 4.3.9 There are no records of sites or findspots dating to the Palaeolithic or Mesolithic within 1km of the survey area. There are large numbers of cropmark features attributed to the Neolithic or Bronze Age in the local area along with some findspots of this date. A Neolithic polished flint axe was found to the northeast of the survey area in 1939 (MST977) with another polished Neolithic axe/adze found to the southwest (MST646). Two circular enclosures, observed on Aerial Photographs (APs) as cropmarks, are considered to possibly represent Bronze Age ring ditches (MST3961). There are more cropmarks to the north west of the survey area around Rileyhill; the closest record mentions the presence of a ring ditch dating to the Neolithic or Bronze Age along with a number of other cropmark features (MST1322). To the west of the survey area is a large mound known as King's Standing; it has been described as a destroyed Bronze Age barrow but its date is uncertain (MST976).
- 4.3.10 There are few records of Roman sites within 1km but it should be noted that fields with visible cropmarks, discussed above, may contain later features in addition to suspected Neolithic or Bronze Age remains. A concentration of cropmarks is located to the north of the survey area; they vary in form and include linear features, a ring ditch, an oval enclosure and a sub-rectangular enclosure. The sub-rectangular enclosure may date to the Roman period but the ring ditch is perhaps more likely to represent a Bronze Age feature (MST1501).
- 4.3.11 There are no records of post-Roman or Anglo-Saxon date within 1km of the survey area. Only one suspected medieval feature is present within 1km; this is perhaps due to the isolated location of the survey area, away from villages that would be the centres of activity at this time. An earthwork bank is located a short distance south of the survey area; it is considered to possibly be medieval and once delineated the boundary between the parishes of King's Bromley and Alrewas (MST6541).
- 4.3.12 The most significant post-medieval site is the Trent and Mersey Canal that runs immediately past the south of the site. It was built by engineers James Brindley and Hugh Henshall and was opened in November 1771 (MST4765). Further to the east at Fradley Junction is the Coventry Canal; this canal was completed in 1787 and was built to link the Trent and Mersey Canal to the Oxford Canal (MST2214). A number of lock bridges, accommodation bridges, mileposts and other services are located along and close to these canals; the relevant DBA should be consulted for further information regarding these features. Alrewas Hayes Farm is located to the northeast of the survey area and has early 18th century origins although little besides the farmhouse survives from this early period. The farmhouse is red brick with a tiled roof and is grade II listed (MST9100 and MST14535).
- 4.3.13 The Ordnance Survey (OS) maps show ponds to the immediate north of the survey area, marked as an old pit. It is present on the 1883 OS map suggesting the site was in use before this time although its exact date of use is unclear (Ordnance Survey 1883).
- 4.3.14 The site of the former RAF Lichfield represents the most significant modern remains; the airfield is located southeast of the survey area. The site was planned as an aircraft storage unit that opened on 1st August 1940. It became one of the country's busiest airfields and was retained by the RAF after the war, serving as a flying school. It was closed in April 1958 and has

	since been used for light industry and storage; this has resulted in much of the site being redeveloped although a few original buildings survive. Pill-boxes and anti-tank cylinders were positioned at 14 sites around the airfield (MST5329).	4.3.23	Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.
4.3.15	<p>Methodology</p> <p>Survey Objectives</p> <p>A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:</p> <ul style="list-style-type: none"> • to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions; • to clarify the presence/absence and extent of any buried archaeological remains within the site; and • to determine the general nature of the remains present. 	4.3.24	<p>The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).</p>
4.3.16	This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.	4.3.25	The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:2000.
4.3.17	<p>Survey Dates</p> <p>A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 5th and 7th June 2013.</p>	4.3.26	<p>Results</p> <p>Introduction</p> <p>The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and areas of increased magnetic response. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 27 to 29).</p>
4.3.18	<p>Grid Location</p> <p>The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).</p>	4.3.27	The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 29). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
4.3.19	A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.	4.3.28	Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
4.3.20	<p>Instruments Used and Survey Method</p> <p>The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).</p>	4.3.29	<p>Interpretation: Archaeology</p> <p>The most noticeable features are a series of positive linear ditch-like anomalies running roughly north-south through the data. There are two at 4000 and 4001 that are set parallel to one another; they have varying magnetic values along their length with strong areas over +2nT and very weak areas less than +2nT. The feature at 4001 has two offshoot ditches at 4002 and 4003 that run out from the ditch at an angle of around 45°, parallel to one another. A third weaker positive linear anomaly is present running from 4004 to 4005, at a slightly differing angle to 4000 and 4001. This feature has values that are mostly less than +2nT and fades into the background entirely in places. All of these features are considered to be ditches and are suspected as former field boundaries or drainage ditches.</p>
4.3.21	Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.	4.3.30	A feature is present on early OS mapping at this rough location on a similar alignment, but it is a single continuous feature rather than three clearly separate ditches as is seen from the geophysical data. It is present on the earliest OS mapping consulted (1883) and is present on the 1976-1989 edition; the feature is no longer visible on site today. It is not clear if this map feature was mapping a field boundary or was mapping drainage features in a simplified way. The map feature may relate to the three ditches but as the correlation isn't exact it shouldn't be taken as a certainty.
4.3.22	<p>Data Processing</p> <p>Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±7nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.</p>		

4.3.31	Another weak ditch, similar to 4005, is present at 4006 and runs parallel to the northern field boundary. This may constitute an earlier field boundary/drainage like the examples discussed above.	4.3.38	There are agricultural features present in the data such as ploughing scars around 4023 and ceramic field drains at 4024. There are other trends in the data classed as uncertain origin such as those around 4025 that may prove to be archaeological.
4.3.32	There are some extremely faint linear and curvilinear positive anomalies around 4009 and 4010 that form very regular anthropogenic patterns in plan. They are weakly positive with magnetic values less than +1nT and if shown to be archaeological may be ditches with a fairly sterile fill or may be buried at a greater depth compared to other features on site. The linear features around 4010 appear to form a rectangular enclosure measuring 10.6m x 9.4m. The curvilinear feature at 4009 appears to cross a linear related to 4010 which may suggest more than one phase is represented in this area. These features are all considered to represent ditches and have been classed as possible archaeology (very weak response) due to their very weak magnetic values.	4.3.39	There is a broad spread of bipolar anomalies around 4026 that is considered to be geological. Within this spread there are numerous positive anomalies; some are fairly strong and irregularly shaped whereas others are far weaker but are more regular in shape. All of these features within this spread have been classed as possible archaeology due to the uncertainty over their interpretation. Another geological spread is present at 4027 but this has much weaker bipolar anomalies than those at 4026.
4.3.33	There are more weak anomalies further north, close to 4003. They are stronger than the anomalies discussed above but are more irregular in form. These features occur on the northern side of 4003 and appear to almost form an enclosure at 4011 but it has an interrupted form. The anomalies are strong in a few places (over +2nT) but are mostly weak with magnetic values less than +2nT. These features are interpreted as archaeological although their slightly irregular form raises some doubts.	4.3.40	Interpretation: Modern Services No clear responses related to modern services were identified in the data. The only responses thought to be representative of pipes were deemed to be ceramic field drains. It should be noted that gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.
4.3.34	There are other weaker features to the north. A curving arc of weak responses at 4012 with some faint linear features to the east may prove to be archaeological. Some weak linear features are present at 4013 and 4014 may also be of interest. These features are considered to possibly represent ditches but have been classed as possible archaeology (very weak response) due to their weak values (less than +1nT).	4.3.41	Conclusions Introduction The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response and numerous trends of uncertain origin.
4.3.35	A line of irregular weak positive responses are present at 4015, aligned parallel to 4005. They have weak magnetic values, less than +2nT, and have a very irregular shape in plan with very diffuse edges. The anomalies look to be natural but their arrangement and common alignment with 4005 suggests they are archaeological. These features possibly represent tree throws that mark some early tree line boundary and are classed as possible archaeology (very weak response) due to their weak values and irregular form.	4.3.42	Discussion The data shows a number of potential archaeological features. The clearest anomalies are the ditches at 4000 to 4005 and these may coincide with an early field boundary marked on early OS maps. The more interesting responses are perhaps the weakest examples such as those around 4009 to 4017; some are clearly anthropogenic in form such as 4009 and 4010 whereas others are less convincing such as 4015.
4.3.36	A very weak, interrupted, linear positive anomaly is present at 4016; it has magnetic values less than +1nT and is considered to represent a ditch with a magnetically sterile fill or a greater depth of burial. Close to this ditch to the east at 4017 is a small weak regular anomaly that appears to form a small rectangular enclosure. It has magnetic values less than +1nT and measures 8.3m x 3.5m, it is unclear what this feature may represent. Both of these features are classed as possible archaeology (very weak response) due to their weak magnetic values.	4.3.43	These anomalies are very weak and this could be due to a number of reasons but the two most convincing reasons may relate to the depth of burial of these features and/or the composition of the fill of these cut features. If these features were buried very deep under alluvium then the gradiometers used for the survey would struggle, or even fail, to detect archaeological features. Also if these features were cut away from occupation/activity then their fills would be composed of less magnetically enhanced debris than if they were cut closer to a settlement and this would reduce the measurable contrast significantly.
4.3.37	A line of concentrated ferrous and increased magnetic response runs down the western side of the survey area from 4018 through 4019 to 4020. These areas are clearly dumps of magnetically enhanced metallic and ceramic debris. It is possible that this spread marks a route from the quarry pit, to the north of the Site, to the canal to transport mined goods and to backfill the pit with rubbish following its abandonment but this is purely conjectural. There are other spreads of increased magnetic response at 4021 and 4022 but as there is less ferrous here these spreads could possibly represent geological anomalies as well as possibly having an anthropogenic cause.	4.3.44	It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

Figures

Figure 26: Site location



References

Bibliography

English Heritage (2008), *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No. 1, 2nd Edition.

Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey (1989), *Post-WWII Staffordshire 1976-1989* (1:10,000).

Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.

Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.

Ordnance Survey (1883), *Pre-WWII Staffordshire 1883-1884* (1:2500).

HER Records Consulted

MST646 – Axe/Adze findspot, King's Bromley.

MST976 – King's Standing Mound, Black Slough, King's Bromley.

MST977 – Axe findspot, South of Alrewas.

MST1322 – Ring ditch, King's Bromley.

MST1501 – Cropmarks, Alrewas.

MST2214 – Coventry Canal (Fradley Junction to Huddlesford Section).

MST3961 – Possible ring ditches, Alrewas.

MST4765 – Trent and Mersey Canal (Brindley Bank to Woodend Lock, King's Bromley).

MST6541 – Parish boundary, King's Bromley and Alrewas.

MST8329 – RAF Lichfield/Fradley Airfield.

MST9100 – Alrewas Hayes Farmhouse, Alrewas.

MST14535 – Alrewas Hayes Farm, Alrewas.

Figure 27: Greyscale plot

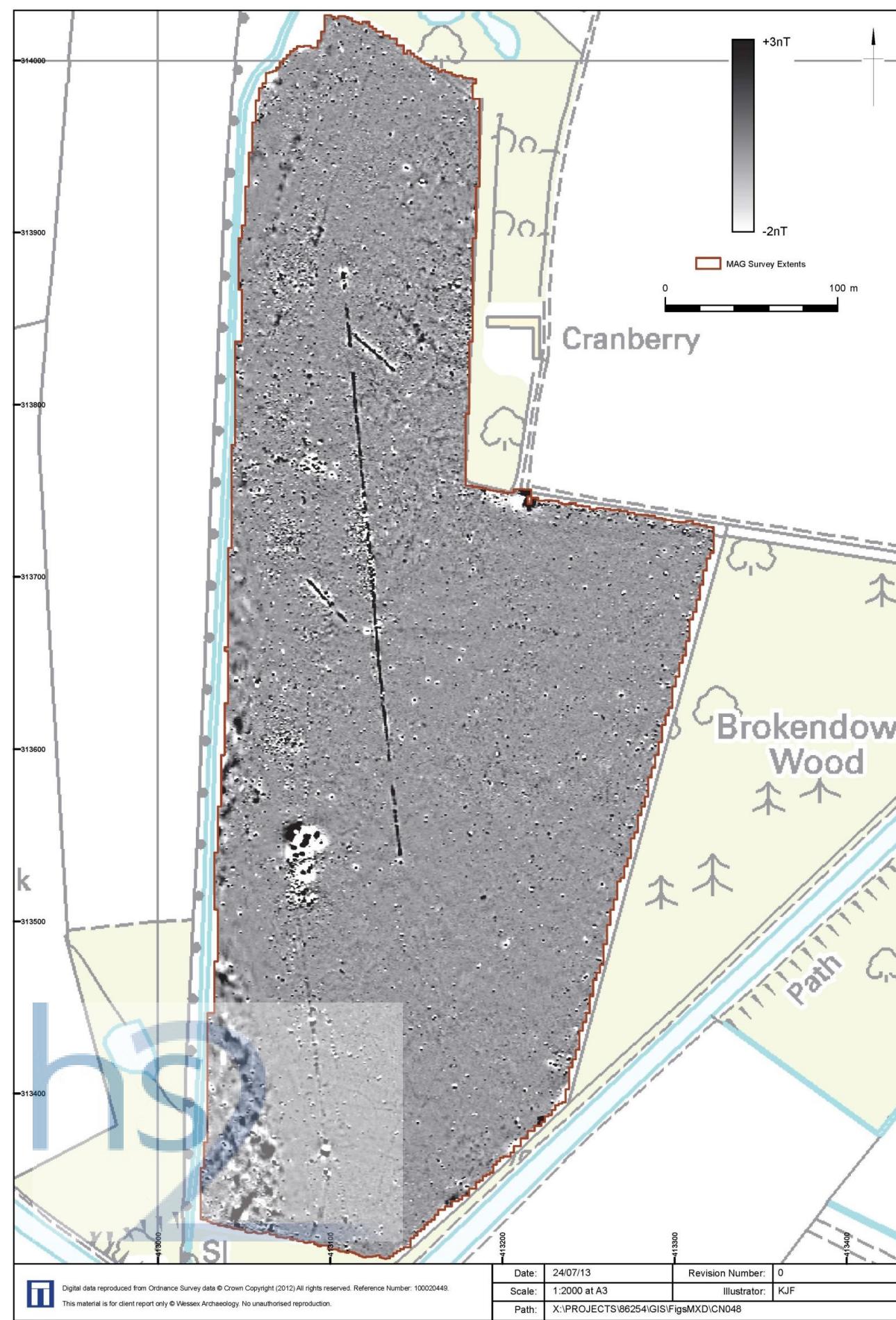


Figure 28: XY trace

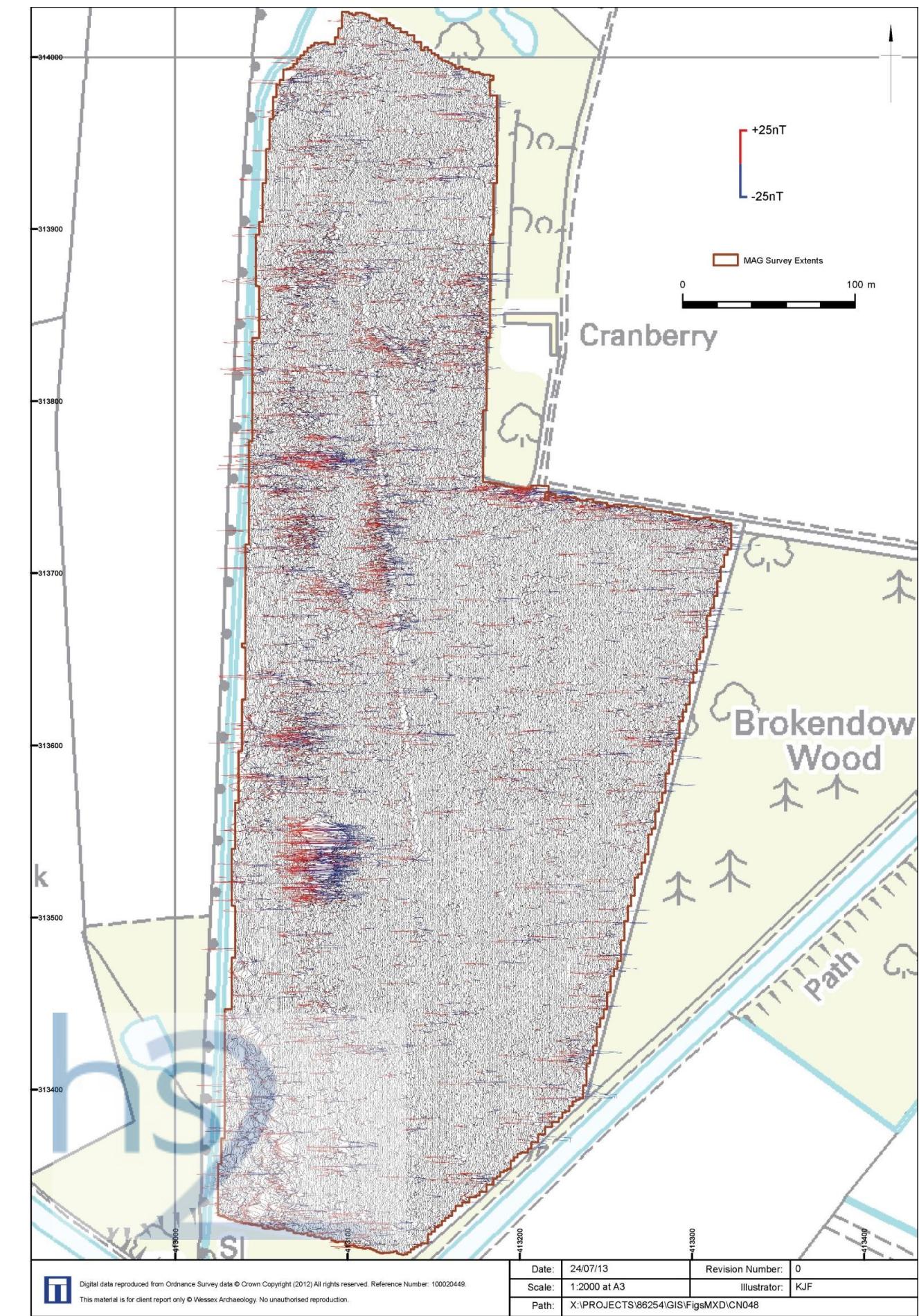


Figure 29: Interpretation



4.4 CN052 Land off Wood End Lane, near Handsacre, Staffordshire

Introduction

Project Background

Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN052 off Wood End Lane, near Handsacre, Staffordshire (Figure 30), hereafter "the Site" (centred on NGR 412024 313790). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.4.1 This Site, CN052, was selected for geophysical survey as it is located within an area of archaeological risk with known remains (risk model score: 2).

4.4.2 The fieldwork was directed by Ross Lefort and assisted by Chris Breeden, Chris Hirst, Charlie Hay and Jonathan Butterly. Ross Lefort processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston and Dr. Paul Baggaley. Illustrations were prepared by Kitty Foster. The project was managed on behalf of Wessex Archaeology by Nicholas Cooke.

Site details

4.4.4 The Site is comprised of two fields located north of Wood End Lane and lies approximately 3.8km southeast of the centre of Handsacre. The limits of the geophysical survey area are defined by modern field boundaries. The site is surrounded by Ravenshaw Wood to the North, west and east.

4.4.5 The Site lies on an area of relatively level land a little above 70m aOD (above Ordnance Datum).

4.4.6 The solid geology is recorded as Pleistocene river gravel (Ordnance Survey 1954).

Methodology

Survey Objectives

4.4.7 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

4.4.8 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

4.4.9 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 13th and 15th August 2013.

	<i>Grid Location</i>	
4.4.10	The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).	4.4.19 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (29). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
4.4.11	A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.	4.4.20 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
	<i>Instruments Used and Survey Method</i>	<i>Interpretation: Archaeology</i>
4.4.12	The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).	4.4.21 The greatest concentration of potential archaeological features lies towards the western end of the Site. Most of these anomalies have very weak magnetic values with typical values less than +2nT, this weak contrast suggests that many more features may be present than are visible in the geophysical data.
4.4.13	Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.	4.4.22 At 4000 is a discrete but intermittent anomaly trending north-west to south-east parallel with the current field boundary and the orientation of the road and extends for approximately 90m. One small discrete positive anomaly along the length of the larger anomaly has been identified and interpreted as archaeology along with several smaller discrete areas interpreted as possibly archaeological in origin. Further to this weak response linear trends along the intermittent length of the anomaly have been tentatively identified as agricultural – ploughing trends. The anomaly is located in the northern boundary area of Shirral Park Deer Park where there is the potential for a former earthwork boundary delimiting the park but this anomaly is also in the same orientation as the current field boundary and there is the possibility that ploughing routes or tracks are also in the same orientation therefore it has been interpreted as possible archaeology with ploughing trends with only one area along it defined as archaeology.
	<i>Data Processing</i>	
4.4.14	Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 7\text{nT}$ thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.	4.4.23 In the area around 4000 are several linear trends interpreted as agriculture – ploughing and they are orientated north-west to south-east. There are numerous small oval and sub-oval shaped discrete positive anomalies in this area which have been interpreted as possible archaeology and could represent pits.
4.4.15	Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.	4.4.24 To the south-east of 4001 are two features, a positive circular anomaly is interpreted as archaeology and could represent a pit and a semi-circular positive anomaly is interpreted as possible archaeology (weak response). This anomaly is larger in shape and if it was an archaeological feature it could represent part of a semi-circular ditch, however it has a very weak magnetic response. Several small circular and sub-oval shaped positive anomalies have been identified as possible archaeology and could represent pits. They do not form a cluster or regular spatial distribution but are scattered randomly throughout the area.
	<i>Data Presentation</i>	
4.4.16	The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).	4.4.25 In the western half of this field around 4002 are several discrete lines of increased magnetic response, these are interpreted as ceramic field drains orientated north-west to south-east and spaced approximately 12m apart. There are numerous ploughing trends across the whole of this field that are considered to be relatively modern.
4.4.17	The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1250.	4.4.26 Anomaly 4003 is a large area measuring approximately 80m x 60m with numerous strong dipolar anomalies interpreted as a concentration of ferrous material, possibly modern debris. Through correlation with available aerial images a cropmark is observable at this location corresponding with the size and shape of the area seen here in the data. One small sub-oval positive anomaly has been identified among the ferrous anomalies and is interpreted as archaeological in origin. It has been described as such due to the uncertain origin of the large area of ferrous material corresponding with an observable cropmark and there are no records
	<i>Results</i>	
	<i>Introduction</i>	
4.4.18	The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 31 and 33).	

- at this location to suggest a cause. The sites within the area are predominantly former earthwork field boundaries of which this anomaly does not take the form or characteristics of; it could possibly represent a pit type feature.
- 4.4.27 A large spreading area approximately 60 x 50m around 4004 has been identified as an area of increased magnetic response and within it are numerous dipolar anomalies interpreted overall as a concentration of ferrous material although the anomalies are weaker and more defined compare to those at 4003. Given the concentration of ferrous material identified immediately to the north-west around 4003 an anthropogenic cause, probably modern debris, is considered more likely.
- 4.4.28 In the eastern half of the field is a second group of ceramic field drains at a different orientation to those around 4002, they are orientated north-east to south-west. This second grouping of field drains survives between two large areas of disturbed ground; 4003 which is an area of numerous ferrous anomalies and 4004 which is an area of increased magnetic response.
- 4.4.29 At 4006 are one oval and two elongated oval shaped positive anomalies, they are interpreted as possibly archaeology (weak response) and are in amongst an area of ceramic field drains. At the location of 4006 and across the Site are small sub-oval shaped positive anomalies and slightly larger elongated positive anomalies. The larger examples tend to have much weaker magnetic values, and the smaller ones tend to have stronger magnetic values, typically over +2nT. These features are considered to represent cut features such as short sections of ditch and smaller features such as pits and postholes.
- 4.4.30 The remaining anomalies of interest consist of small, sub-circular or sub-oval shaped positive anomalies and weak linear trends. The small positive anomalies are considered to possibly represent cut features such as small pits and postholes although geological explanations are also possible. The weak trends are considered to either represent ploughing trends set at an angle to the prevailing direction of ploughing or are weak archaeological features. As there is no significant patterning in their spatial distribution they have been classed as possible archaeology (small positive anomalies) and uncertain origin (trends). Some of the smaller, stronger anomalies may prove to be part of small ferrous anomalies that do not have an obvious negative region associated with it. These anomalies have mostly been classed as possible archaeology.
- Interpretation: Modern Services**
- 4.4.31 There are no modern services identified in the survey area, however as mentioned above, an overhead electricity pylon crosses the field north to south therefore this disturbance is visible in the data.
- 4.4.32 At 4005 in the south-west corner of the survey area is a broad area of positive magnetic response, this is in the vicinity of an electricity pylon and is probably attributable to that.
- Conclusions**
- Introduction**
- 4.4.33 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response, the presence of ceramic field drains across two areas of the Site and numerous trends of uncertain origin.

Discussion

- 4.4.34 The data shows one archaeological feature that may be associated with records of a possible boundary of a medieval deer park. The anomaly labelled 4000 is considered to be the most relevant to these records. This area could be the location of the former earthwork boundary or the anomalies identified could represent agricultural features associated with post-medieval to modern agricultural practices since it was disemparked.
- 4.4.35 There are several other likely archaeological features located within the Site, most notably 4001 and 4003, these features are considered to represent pits and a tentatively identified semi-circular ditch but it is unclear as to the period they could date to.
- 4.4.36 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

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- Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.
- Wessex Archaeology (2013), HS2: *Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER Records Consulted

- MST 1124 – Drayton Manor House.
- MST 3403 – & Pastscape ID 306718 – Cropmarks; Possible Iron Age field system.
- MST 4006 – Shirral Park Deer Park.
- MST 6134 – Dam; Earthwork bank; Loddy Wood.
- MST 6135 – Findspot; Medieval pottery sherd.
- MST 6138 – Findspot; Mesolithic/Neolithic flints.
- MST 6141 – Findspot; Prehistoric potsherd.
- MST 6142 – Findspot; Romano-British and Medieval coin and potsherds.
- MST 6147 – Earthwork bank and ditch; Shirral Coppice.

MST 6148; Boundary bank; curving linear feature.

MST 6299 – Drayton Manor Park and Gardens.

English Heritage PastScape Records

Pastscape ID 1521646 – Possible site of World War Two searchlight battery no.350 BG09 7.

Figures

Figure 30: Site location

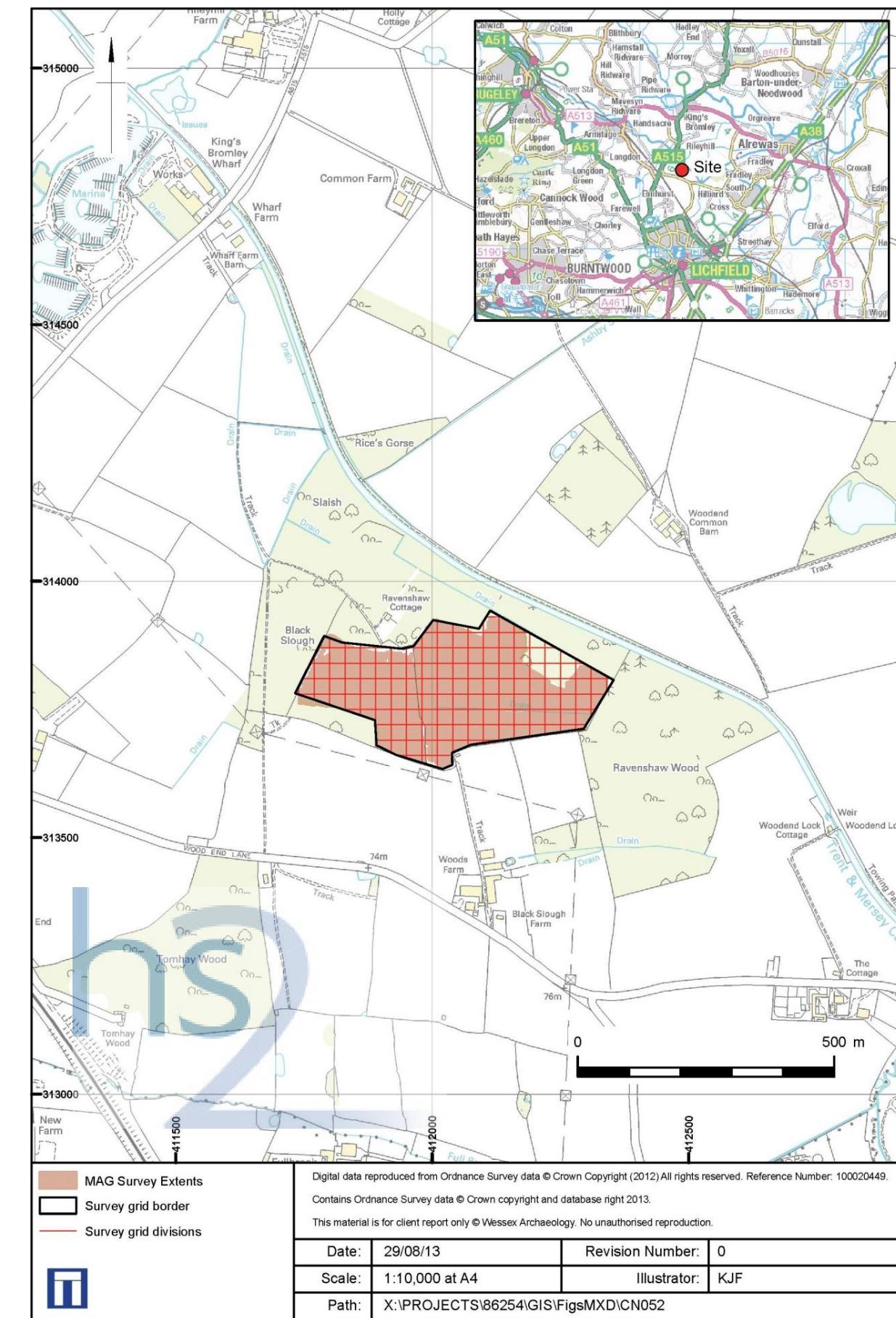


Figure 31: Greyscale plot

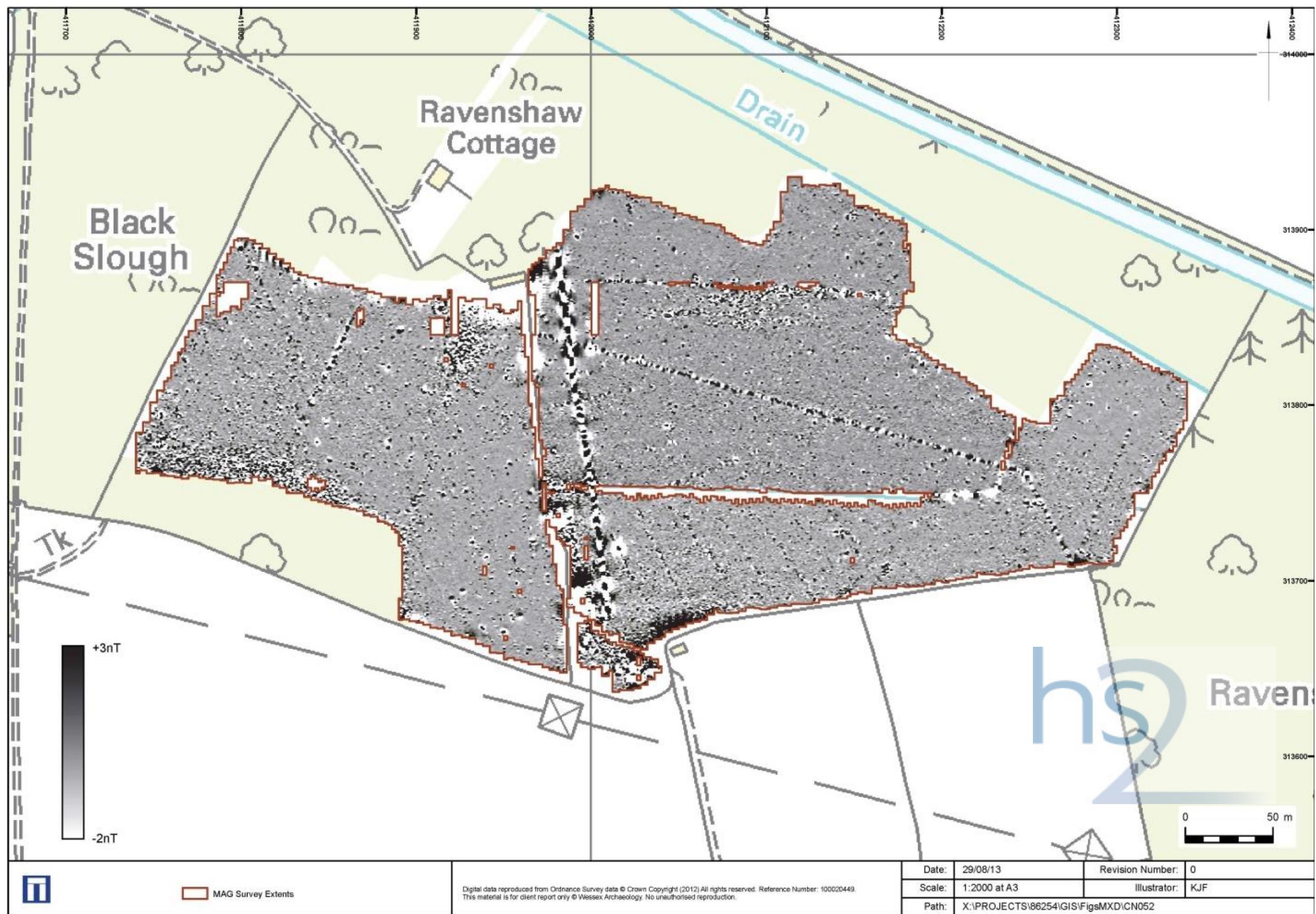


Figure 32: XY trace

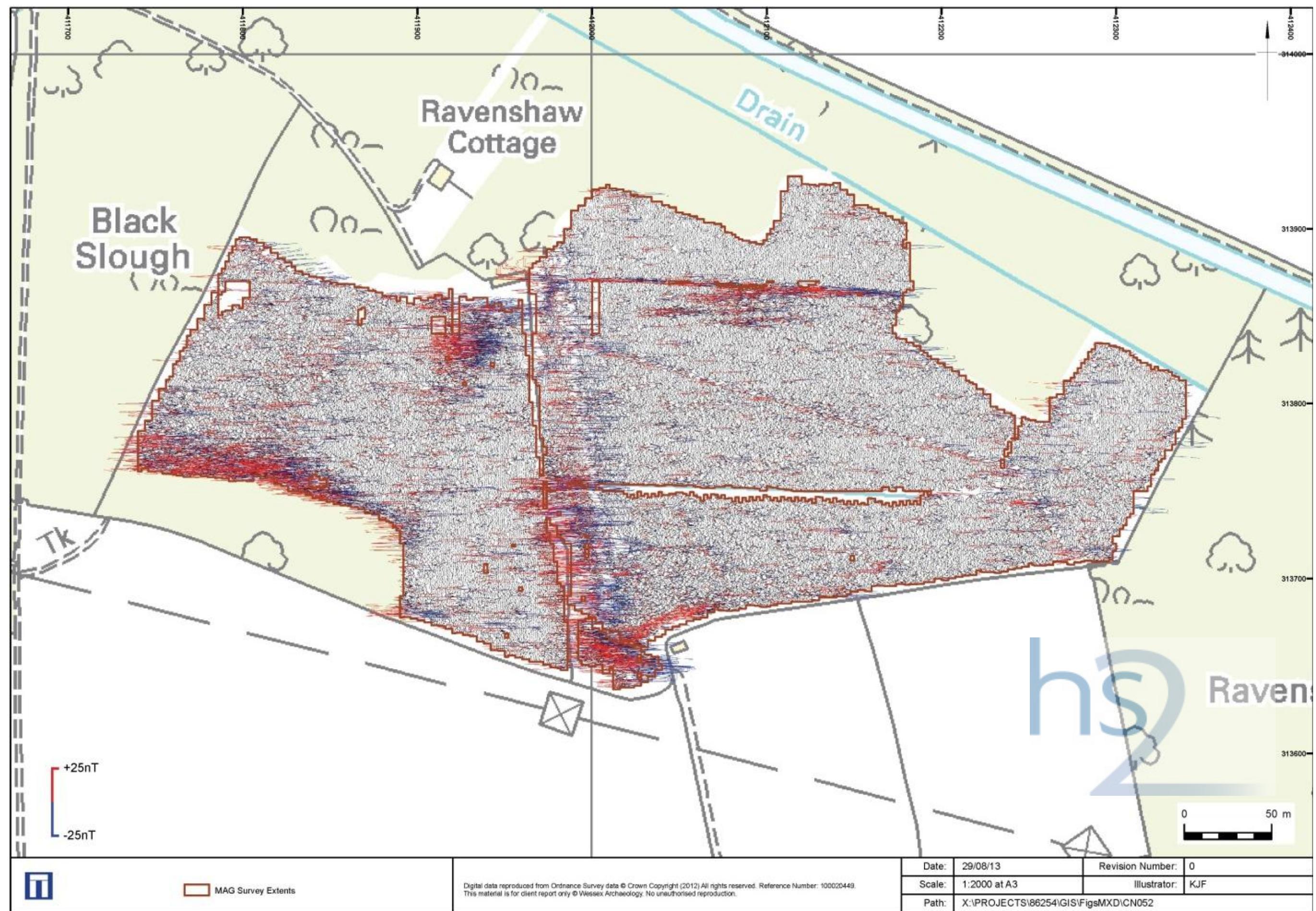
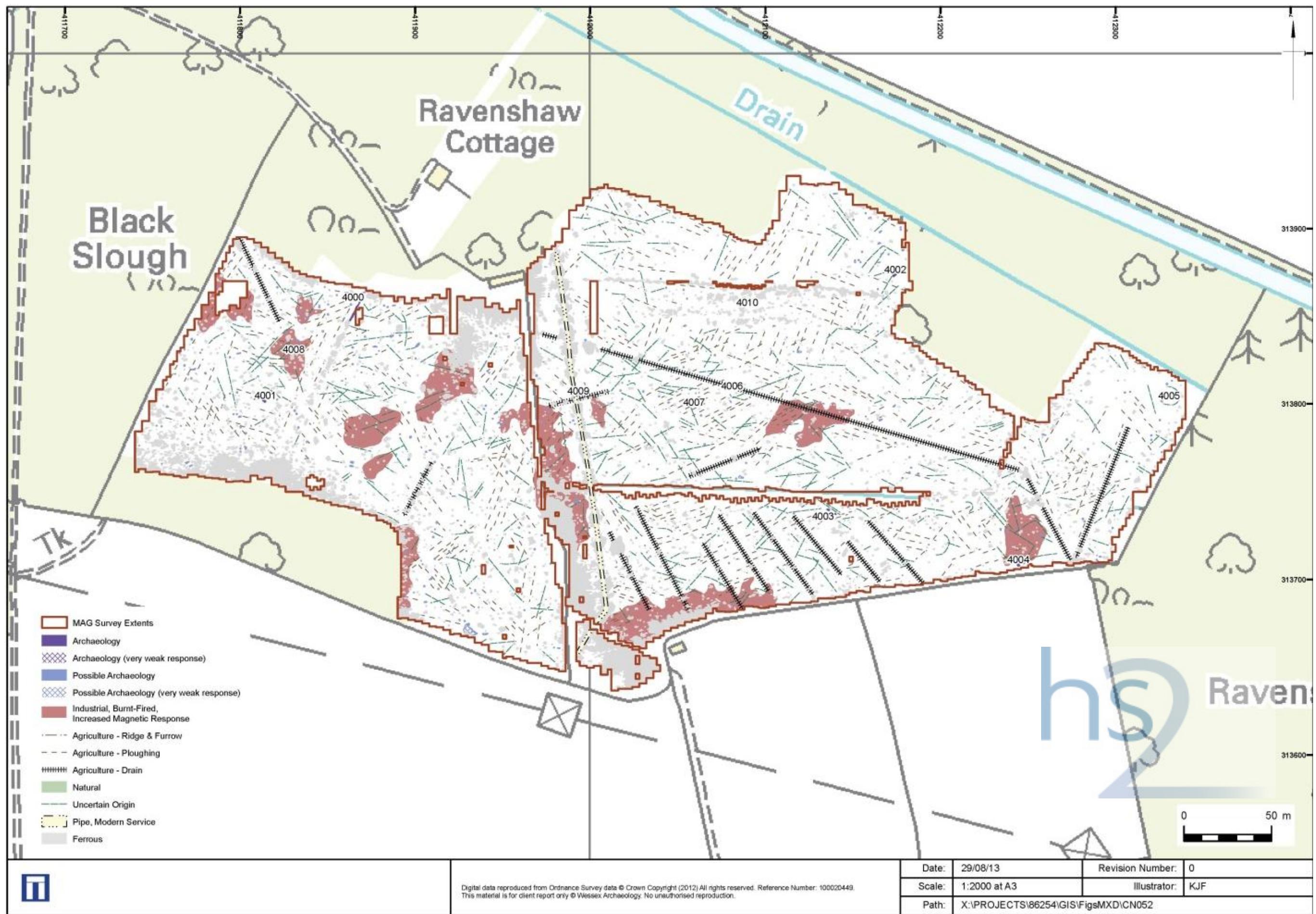


Figure 33: Interpretation



4.5 CN055 Land near King's Bromley, Staffordshire

Introduction

Project Background

4.5.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN055 on agricultural land near King's Bromley, Staffordshire (Figure 34), hereafter "the Site" (centred on NGR 410625 314175). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.5.2 This Site, CN055, was selected for geophysical survey as it is close to known archaeological remains. It is considered to be an area at medium risk (risk model score: 3).

4.5.3 The fieldwork was directed by Alistair Black and assisted by Chris Hirst, Jonathan Buttery and Phil Roberts. Ross Lefort processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston and Dr. Paul Baggaley. Illustrations were prepared by Kitty Foster. The project was managed on behalf of Wessex Archaeology by Nicholas Cooke.

Site details

4.5.4 The Site comprises one pasture field located off Shaw Lane with a railway running along the southwest edge of the survey area. The Site lies approximately 3km southwest of the centre of King's Bromley and 5.1km north of the centre of Lichfield. The limits of the geophysical survey area are defined by field boundaries with the southwest limits defined by a railway line. The Site comprises one pasture field with numerous trees and dense areas of woodland within. Geophysical survey was undertaken over all accessible areas of the Site with a fairly large area lost to obstructions, in this case trees and woodland. The area of data coverage came to around 9.2ha.

4.5.5 The Site lies on an area of gently sloping land that slopes downwards towards the east; the land lies at a height around 75m aOD (above Ordnance Datum). A small stream flows past the southeast side of the Site, named Bourne Brook. The brook flows northeast across the Trent and Mersey Canal and into the River Trent, close to its confluence with the River Swarbourne.

4.5.6 The solid geology is recorded as Keuper marl and is likely to be composed of mudstone (Triassic); sandstone of the same date is recorded very close by (Ordnance Survey 1957). The superficial deposits recorded on Site are river terrace deposits (mainly sand and gravel) that were formed in the Quaternary. There are likely to be alluvial deposits close to the brook that flows along the edge of the Site and glacial deposits are recorded nearby (Ordnance Survey 1977).

4.5.7 The soils underlying most of the Site are likely to be typical brown sands of the 551d (Newport 1) association. There are likely to be deposits of typical sandy gley soils of the 821b (Blackwood) association along the northeast edge of the site (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

4.5.8 There are no records of archaeological sites within the survey area. Sites located within 1km of the survey area will be discussed; for a full account of the recorded heritage assets the appropriate Desk-Based Assessment (DBA) should be consulted.

4.5.9 No Palaeolithic or Mesolithic records are located within 1km of the survey area. A Neolithic perforated stone axe-hammer was found to the north of the survey area (MST2011). A probable prehistoric pit alignment, three Bronze Age round barrows and a series of linear features are visible on Aerial Photographs (APs) to the east of the survey area (MST1323 and EH1431604). There are more cropmarks to the northeast of the survey area around Rileyhill; the closest record mentions the presence of a ring ditch dating to the Neolithic or Bronze Age along with a number of other cropmark features (MST1322).

4.5.10 No Roman or post-Roman records are located within 1km of the survey area. The medieval features present seem to all relate to a nearby Deserted Medieval Village (DMV) at Fisherwick. A medieval well, lined with limestone, was found during an archaeological evaluation; it is located to the southwest of the survey area and is thought to be associated with Fisherwick DMV (MST13054). Along with medieval pottery a sherd of post-medieval pottery was recovered from the well fill (MST13055). Several undated linear ditches were found close to the well; these are also considered to be associated with Fisherwick (MST13056). Medieval or post-medieval ridge and furrow was identified from APs to the west of the survey area (MST5355).

4.5.11 The most significant post-medieval site is the Trent and Mersey Canal that runs past the northeast of the survey area. It was built by engineers James Brindley and Hugh Henshall and was opened in November 1771 (MST4765). A number of locks, bridges, mileposts and other services are located along and close to this canal; the relevant DBA should be consulted for further information regarding these features.

4.5.12 A quarry pit was identified during an evaluation to the southwest of the survey area that was found to date to the post-medieval period (MST13366). A watermill complex with origins before 1775 is located to the SSW of the survey area (MST2253). The listed building at Hanch Hall lies to the west of the survey area and was constructed in the 18th century although earlier features and materials were used in its construction (MST5224). There are other listed buildings within 1km of the survey area; the relevant DBA should be consulted for information concerning these sites.

4.5.13 A Second World War searchlight battery (no. TL01 1) was located at Hanch Hall, west of the survey area, and was operational by April 1941 (EHTL01 1). An undated mound was identified from APs in 1969 to the southwest of the survey area (MST5286).

Methodology

Survey Objectives

4.5.14 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within

	the site; and	4.5.24	The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1250.
4.5.15	• to determine the general nature of the remains present.		
4.5.15	This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.	4.5.25	Results <i>Introduction</i> The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and two modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1250 (Figures 35, 36, 38 and 39).
4.5.16	Survey Dates A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 25th and 26th June 2013.	4.5.26	The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 37, 40 and 41). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
4.5.17	Grid Location The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).	4.5.27	Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
4.5.18	A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.	4.5.28	<i>Interpretation: Archaeology</i> A number of interesting features are present across the Site with the greatest concentration of archaeological features located towards the north of the survey area. A rectangular enclosure is located off of the northwest side of the survey area and is visible at 4000, 4001 and 4002. This enclosure is defined by intermittent positive responses with variable magnetic values across its length ranging from over +5nT at the strongest points to less than +1nT at the weakest regions. The enclosure measures approximately 80m x 100m although the north western side is not clearly defined due to the presence of a wide spread of ferrous responses. This feature is considered to be archaeological and either represents a boundary defined by a cut feature such as a ditch that has been damaged by later activity or is a fence line that is defined by postholes. Given the intermittent form a post built structure is considered more likely.
4.5.19	Instruments Used and Survey Method The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).	4.5.29	There are a number of other features inside of this enclosure that look to be archaeological and this includes a weak rectangular positive anomaly at 4003. This feature measures approximately 9m x 4m and has weak magnetic values, less than +1.5nT. The origin of this anomaly is unclear, although it is consistent with a cut feature; its common alignment with the surrounding enclosure (northeast-southwest) may suggest they are related. Elsewhere within the enclosure are a number of pit-like responses around 4004 that are located close to and within an area of increased magnetic response. These features range in shape from sub-circular anomalies to slightly elongated sub-oval anomalies and the largest measures 2.3m in length; they all have magnetic values over +2.5nT.
4.5.20	Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.	4.5.30	To the southeast of this enclosure are a series of weak responses, some of which may form another enclosure on the same alignment. An L-shaped weakly positive response at 4005 is set on the same alignment as the previous enclosure with magnetic values less than +1.5nT. This feature is interrupted by another weak linear at 4006 that is aligned roughly east-west, it is not clear whether this feature relates to 4005 or dates to a different period. There is another linear at 4007 that runs parallel to 4005 and extends from the western end of 4006. This feature has a more complicated form in plan but is considered to be related to 4005 and possibly 4006 also. These three features (4005, 4006 and 4007) appear to form another enclosure although it is
4.5.21	Data Processing Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±6nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The deslope function was used to correct errors that resulted from imperfections in the ZMT function caused by areas of dense ferrous responses. These three steps were applied to all survey data, with no interpolation applied.		
4.5.22	Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.		
4.5.23	Data Presentation The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).		

	less well defined than the enclosure discussed above. The enclosure measures at least 46.5m in length and approximately 15.5m in width.	4.5.39	There are numerous small positive anomalies scattered throughout the data; these could represent anything from data spikes to small archaeological features such as postholes. These anomalies are interpreted as possible archaeology as they form no significant patterning in their spatial distribution to suggest greater archaeological significance.
4.5.31	Within this enclosure is a curving positive anomaly at 4008; it does not form a complete ring and has weak magnetic values less than +1.5nT. This feature is considered to be archaeological due to the regular shape of the observed arc and may represent a ditch or a gully.	4.5.40	There are two parallel services visible in the data at 4026 but these will be discussed below.
4.5.32	There are isolated positive anomalies elsewhere in the data that are considered to be archaeological at 4009, 4010 and 4011. The feature at 4009 is sub-oval in shape with strong positive values over +5nT and a length of 2.7m. This feature has been classed as archaeology and is considered to represent a pit. The other features at 4010 and 4011 are short and weak linear anomalies; they may form archaeological features such as ditch sections but have been classed as possible archaeology (very weak response) as their interpretation is uncertain.	4.5.41	The remaining anomalies are a series of weak irregularly shaped positive features at 4027 and 4028 with very diffuse edges. They are concentrated towards the southeast end of the survey area and are considered to be geological features and have been classed as natural.
4.5.33	A weak T-shaped positive anomaly is visible at 4012 on the same alignment as the two enclosures discussed above; it has weak magnetic values around +1nT to +1.5nT and appears to continue further southeast into unsurveyed areas of the Site. This section of the feature is classed as archaeology (weak response) and is considered to represent a cut feature such as a ditch. There are a number of short ditch sections and pits around this section of ditch at 4013, 4014 and 4015; they all have strong magnetic values and are considered to be archaeological.	4.5.42	Interpretation: Modern Services Two modern services have been identified in the data close to 4026; these services appear to be cables aligned roughly parallel to one another, aligned northeast to southwest. Both services run beyond the extents of the survey area and most likely continue further into unsurveyed areas of this field.
4.5.34	This T-shaped anomaly lines up with a map feature named Fox Covert and may continue as spreads of ferrous and increased magnetic response at 4019, 4020 and near 4017 along with still being preserved in modern boundaries. The feature is marked on the earliest maps consulted (1884) as Fox Covert but is known as John's Gorse from by 1902 (Ordnance Survey 1884 and 1902). Some form of boundary is marked on these maps that very closely correspond to these anomalies. This area may have been defined by a ditch but this ditch may have filled with ferrous/ceramic debris to the west making it impossible to identify a ditch in the geophysical data here. The function of this enclosure is unclear but the name Fox Covert may suggest the enclosure was linked to hunting activity.	4.5.43	It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.
4.5.35	Two pit-like positive anomalies are located within a spread of increased magnetic response at 4016; they are roughly sub-oval in shape and have strong magnetic values. They are classed as archaeology and are considered to represent pits; there are other similar anomalies in the vicinity.	4.5.44	Conclusions Introduction The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response and numerous trends of uncertain origin. At least two modern services were detected.
4.5.36	An L-shaped anomaly is present at 4017 with fairly weak positive magnetic values less than +2nT. It is unclear whether this anomaly represents part of an enclosure but it is classed as archaeology and is considered to represent a ditch.	4.5.45	Discussion A number of potential archaeological features have been identified in the data; most of these features are aligned with the current regime of field division that might give some rough indication of date. One of these features (4012) has been linked to a map feature named as a Fox Covert and may represent an area where a hunt party might search for a fox to chase. The other features and enclosures identified in the data cannot be linked to any map features although are set on a similar alignment to these mapped features.
4.5.37	Two large pits are located around 4018; both are sub-oval in shape with the larger of the two measuring 4.2m in length. They have strong magnetic values over +5nT and are considered to be archaeological representing pits. A boundary is visible in the data at 4021 that is defined by ferrous responses; this might constitute a metal fence or a wooden post one with wire forming a boundary. This boundary is considered to be relatively modern in date.	4.5.46	The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.
4.5.38	Ploughing trends are visible across the data set with noticeable concentrations at 4022 and 4023. There are other trends in the data that are not as clearly linked to agricultural activity such as at 4024 and 4025. These trends have been classed as uncertain origin due to uncertainties in their interpretation.	4.5.47	It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

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Ordnance Survey (1884), *Pre-WWII Staffordshire 1:2500*.

Wessex Archaeology (2013), HS2: *Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER Records Consulted

MST1322 – Ring ditch, King's Bromley.

MST1323 – Ring ditches and linear features, King's Bromley.

MST2011 – Axe-hammer findspot, King's Bromley.

MST2253 – Seedy Mill, Curborough.

MST4765 – Trent and Mersey Canal (Brindley Bank to Woodend Lock, King's Bromley).

MST5224 – Hanch Hall, Longdon.

MST5286 – Mound, King's Bromley.

MST5355 – Ridge and furrow, Longdon.

MST13054 – Well, Fisherwick, King's Bromley.

MST13055 – Pottery findspot, Fisherwick, King's Bromley.

MST13056 – Linear ditches, Fisherwick, King's Bromley.

MST13366 – Quarry pit, Tewnalls Lane, King's Bromley.

English Heritage PastScape Records

Monument No. 1431604 – Probable prehistoric pit alignment and Bronze Age barrow (EH1431604).

Searchlight Battery TL01 1 (EHTL01 1).

Figures

Figure 34: Site location

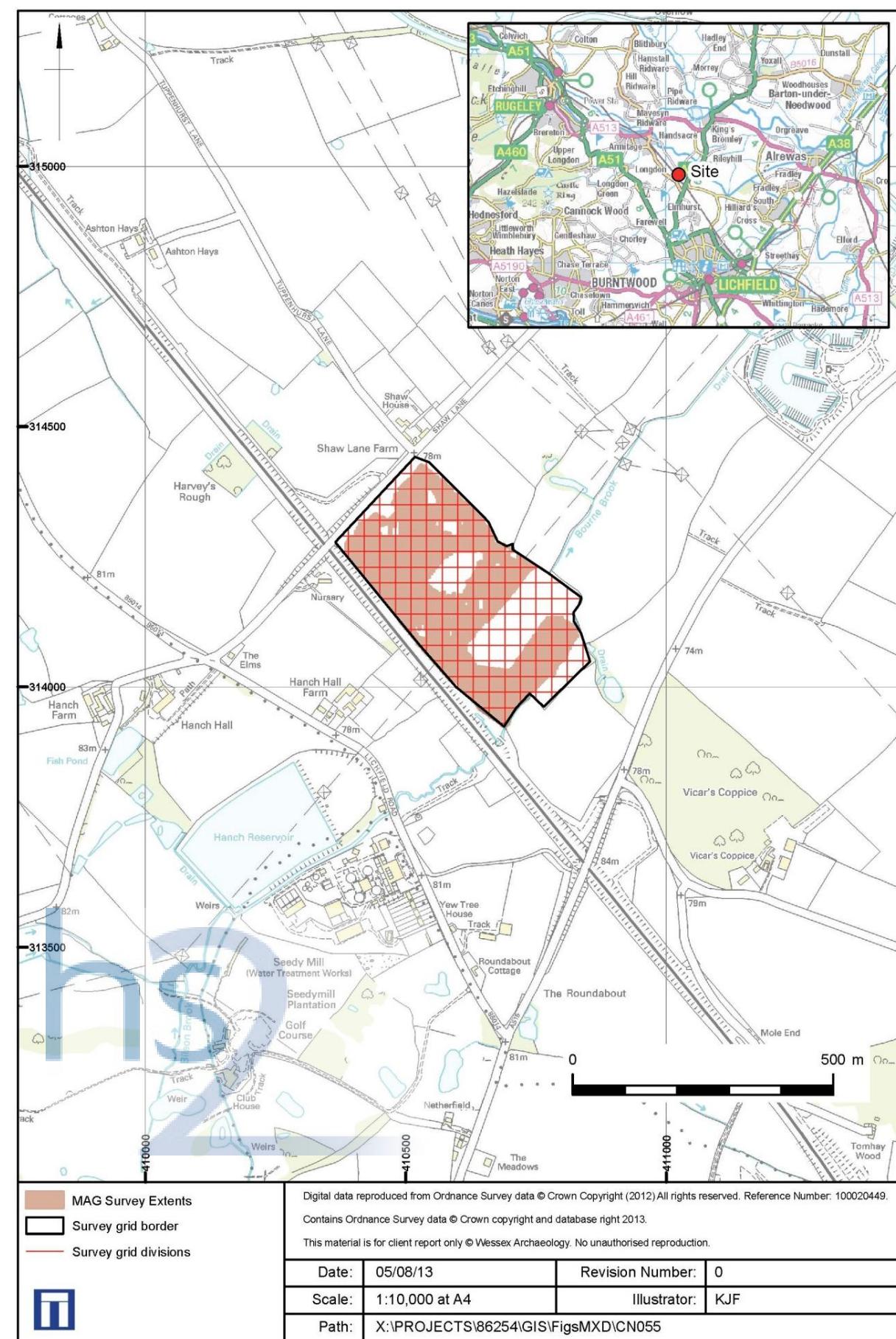


Figure 35: Greyscale plot: North-west

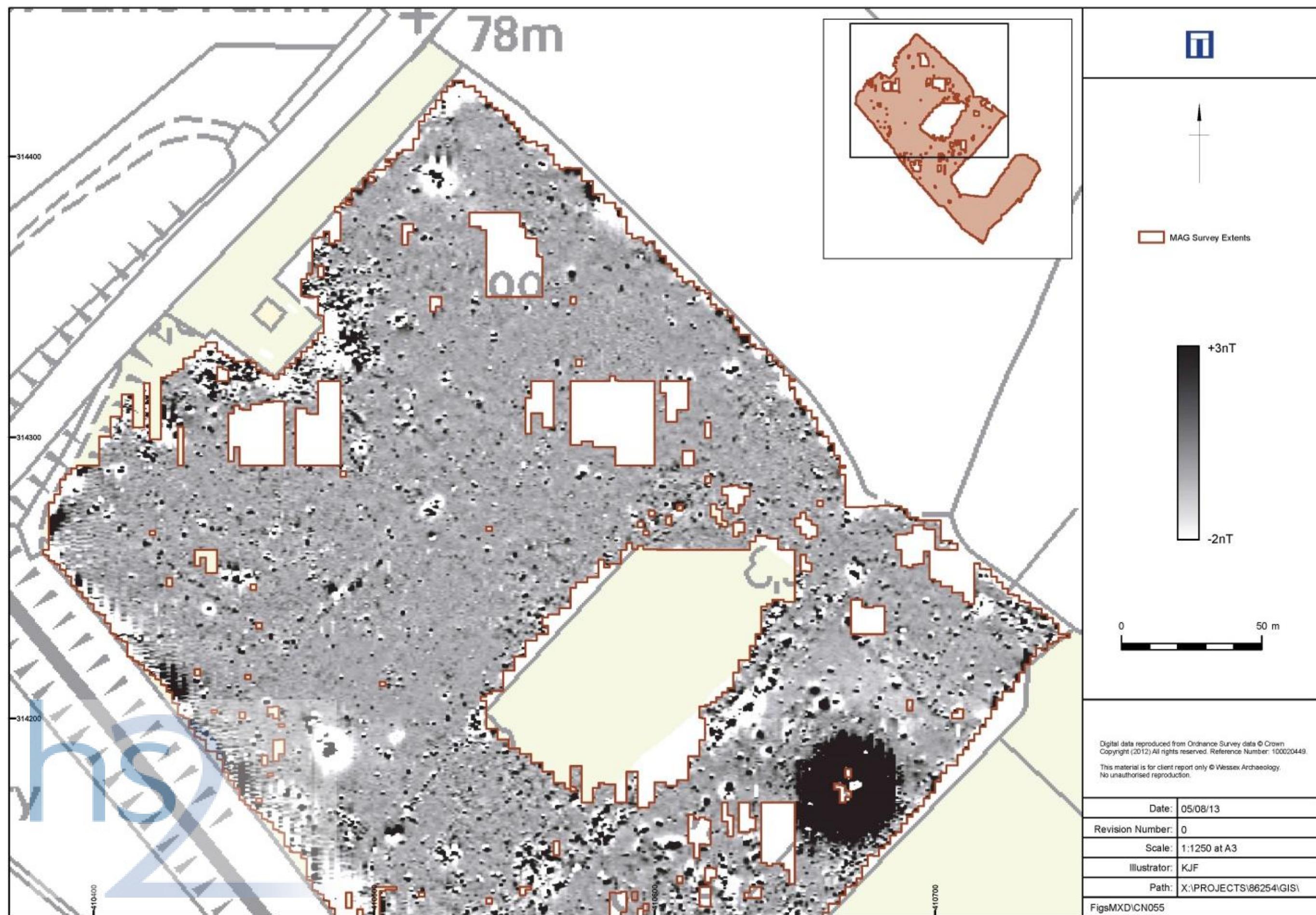


Figure 36: XY trace: North-west

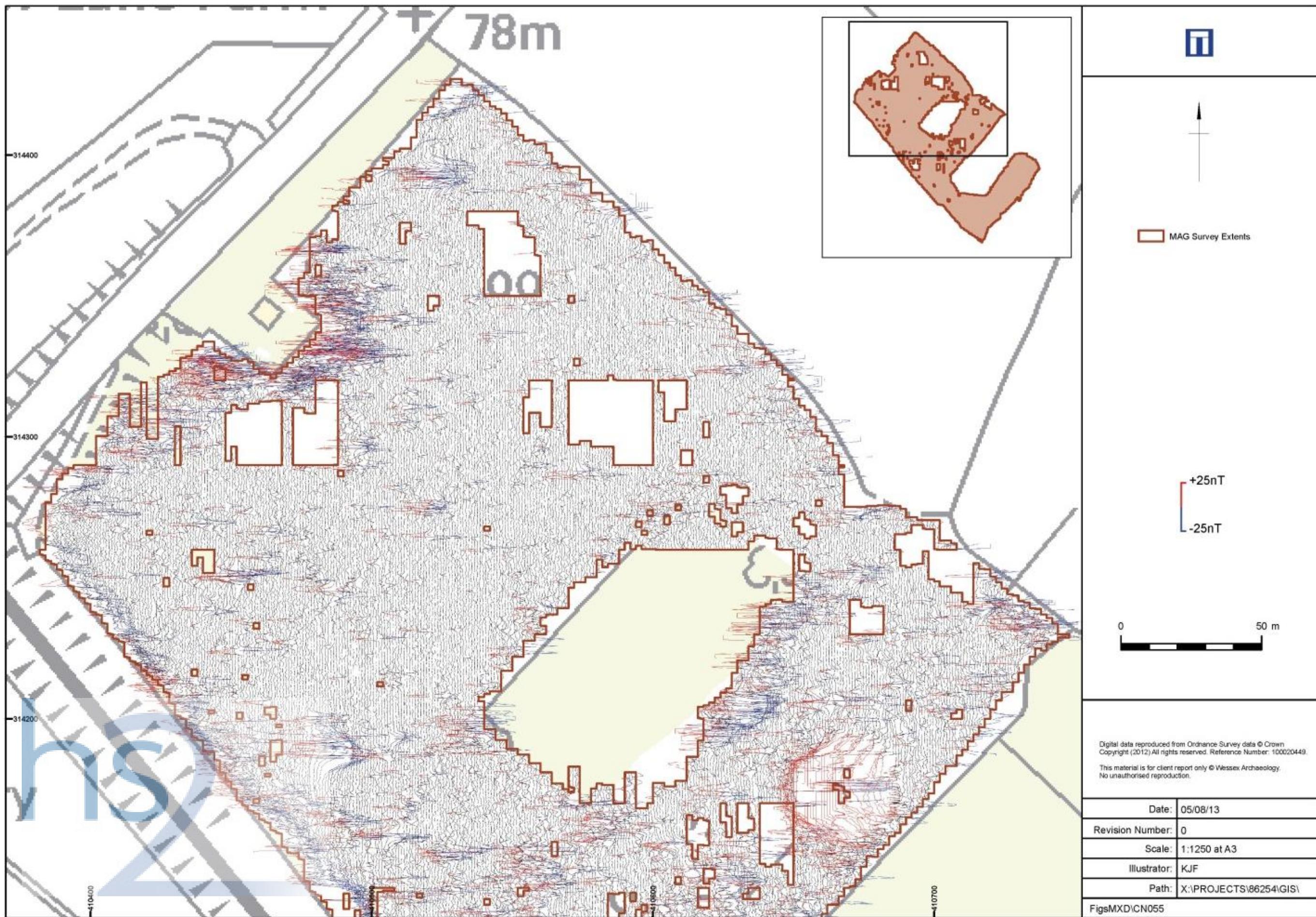


Figure 37: Interpretation: North-west

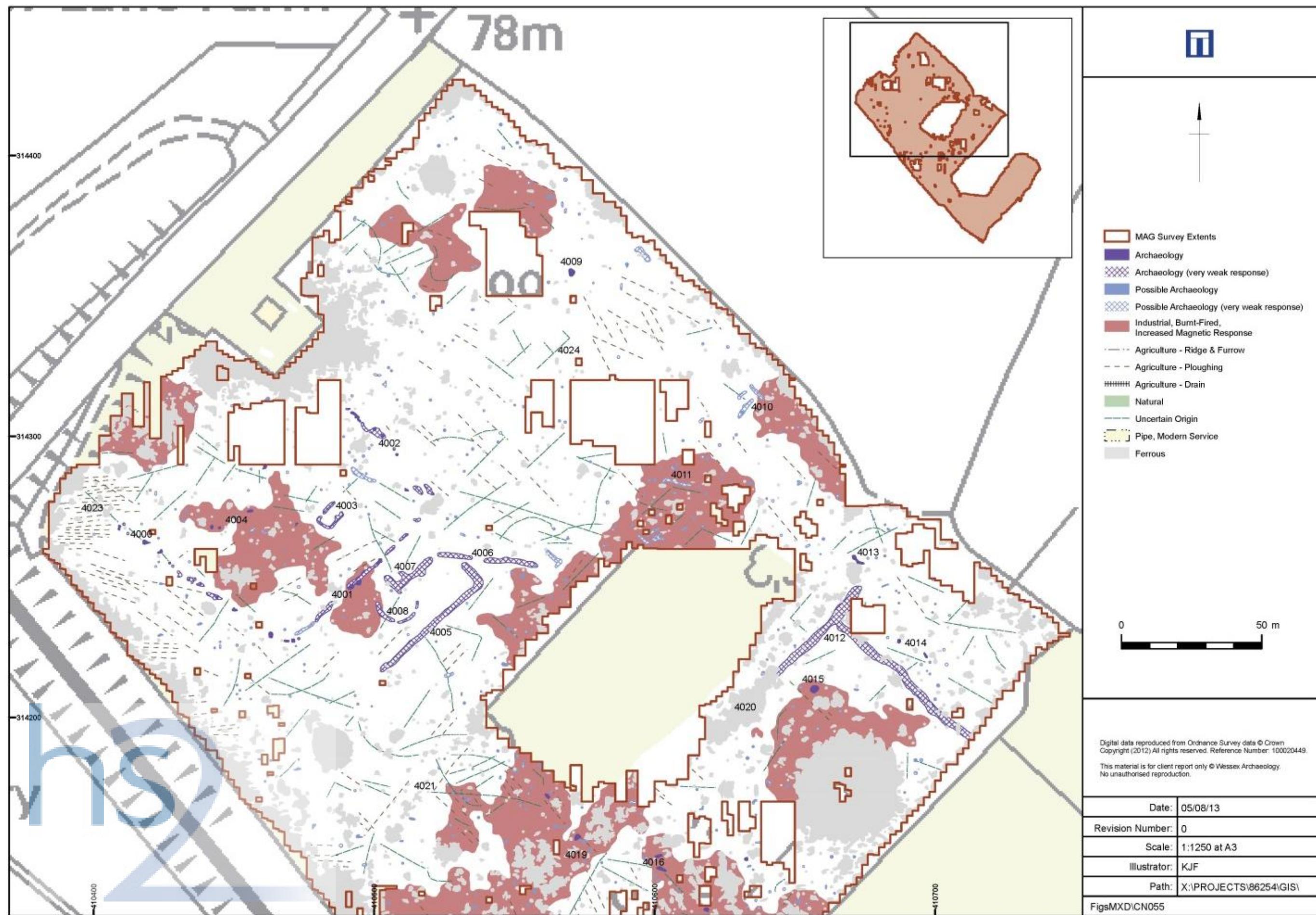


Figure 38: Greyscale plot: South-east

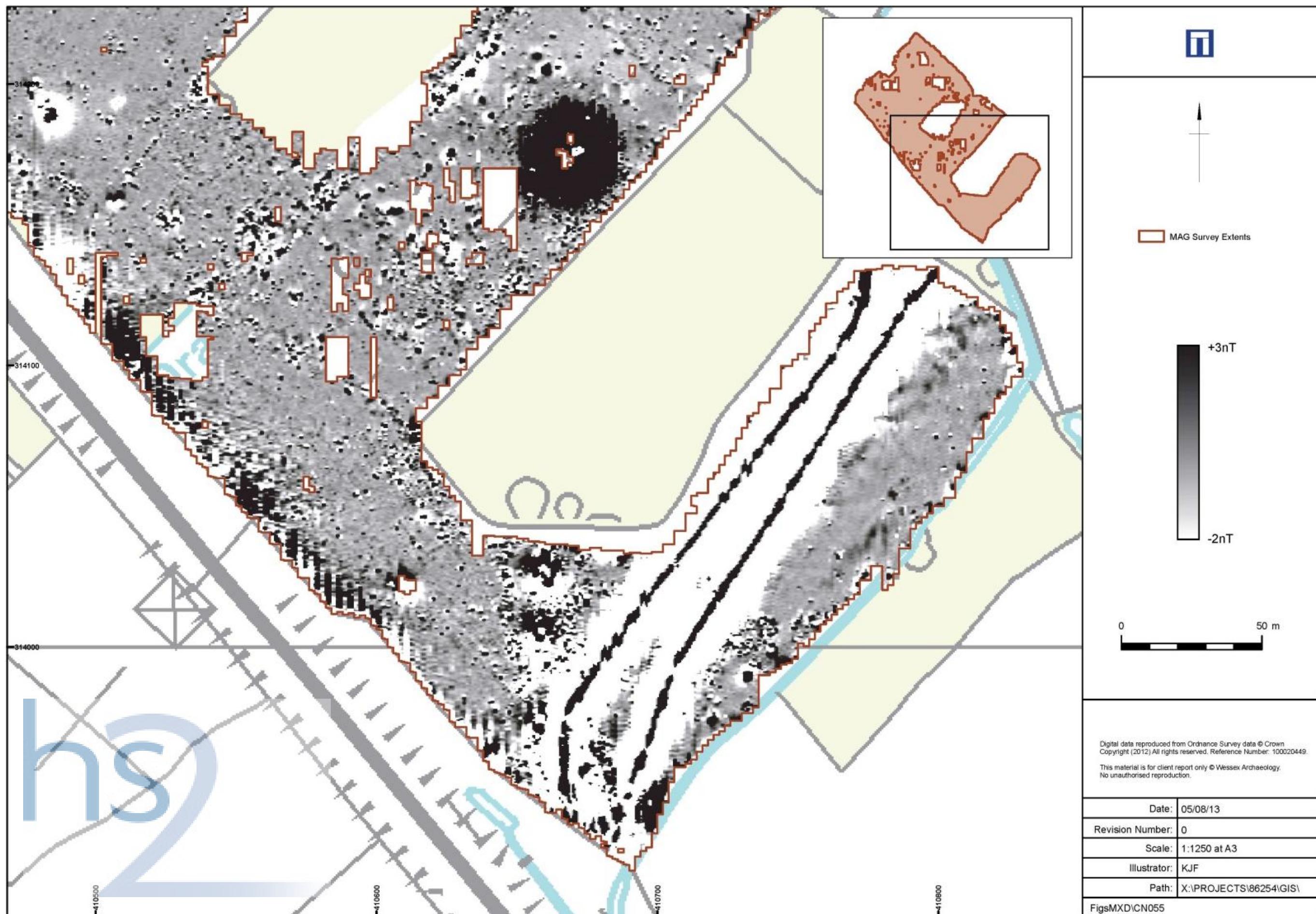


Figure 39: XY trace: South-east

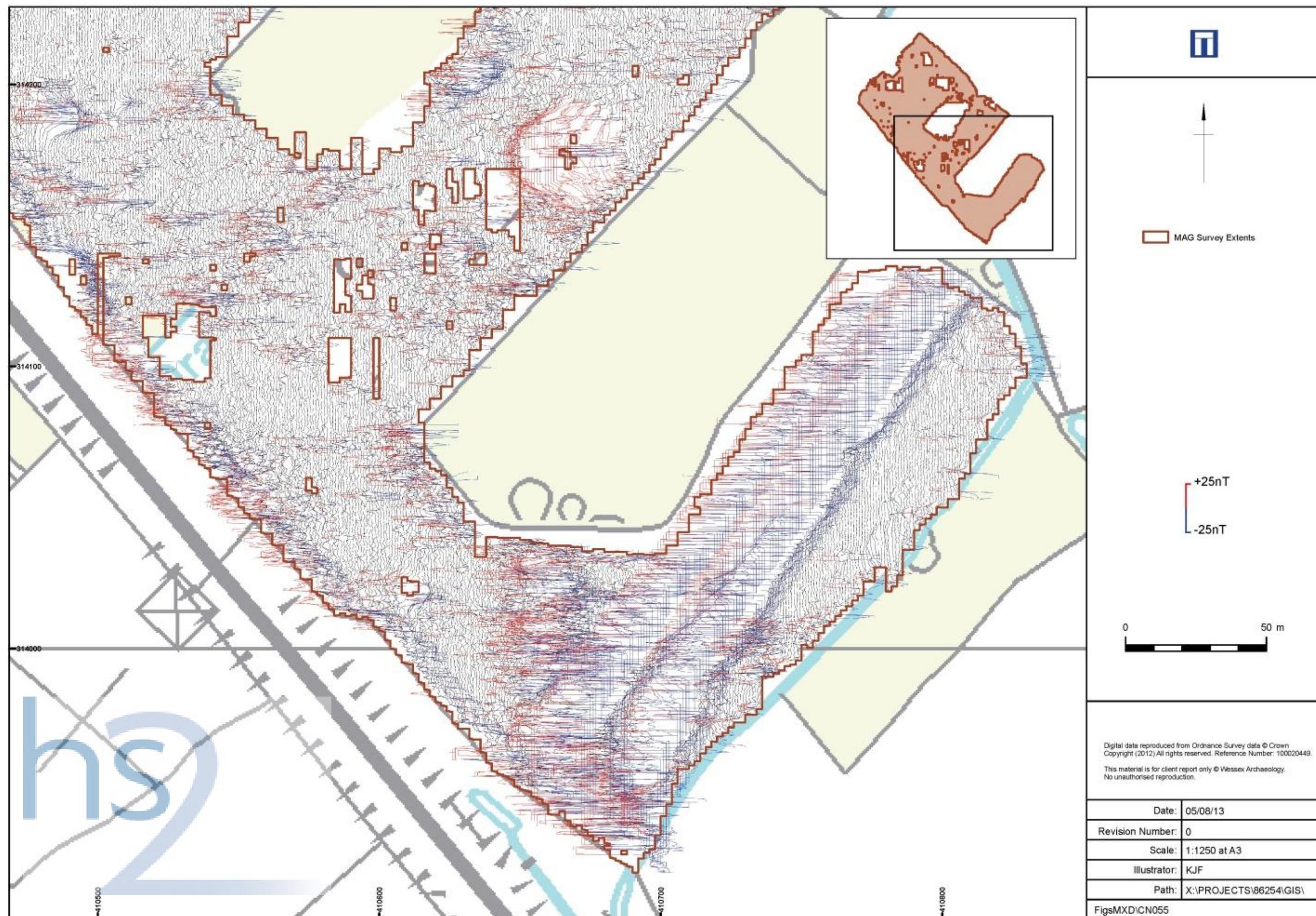


Figure 40: Interpretation: South-east

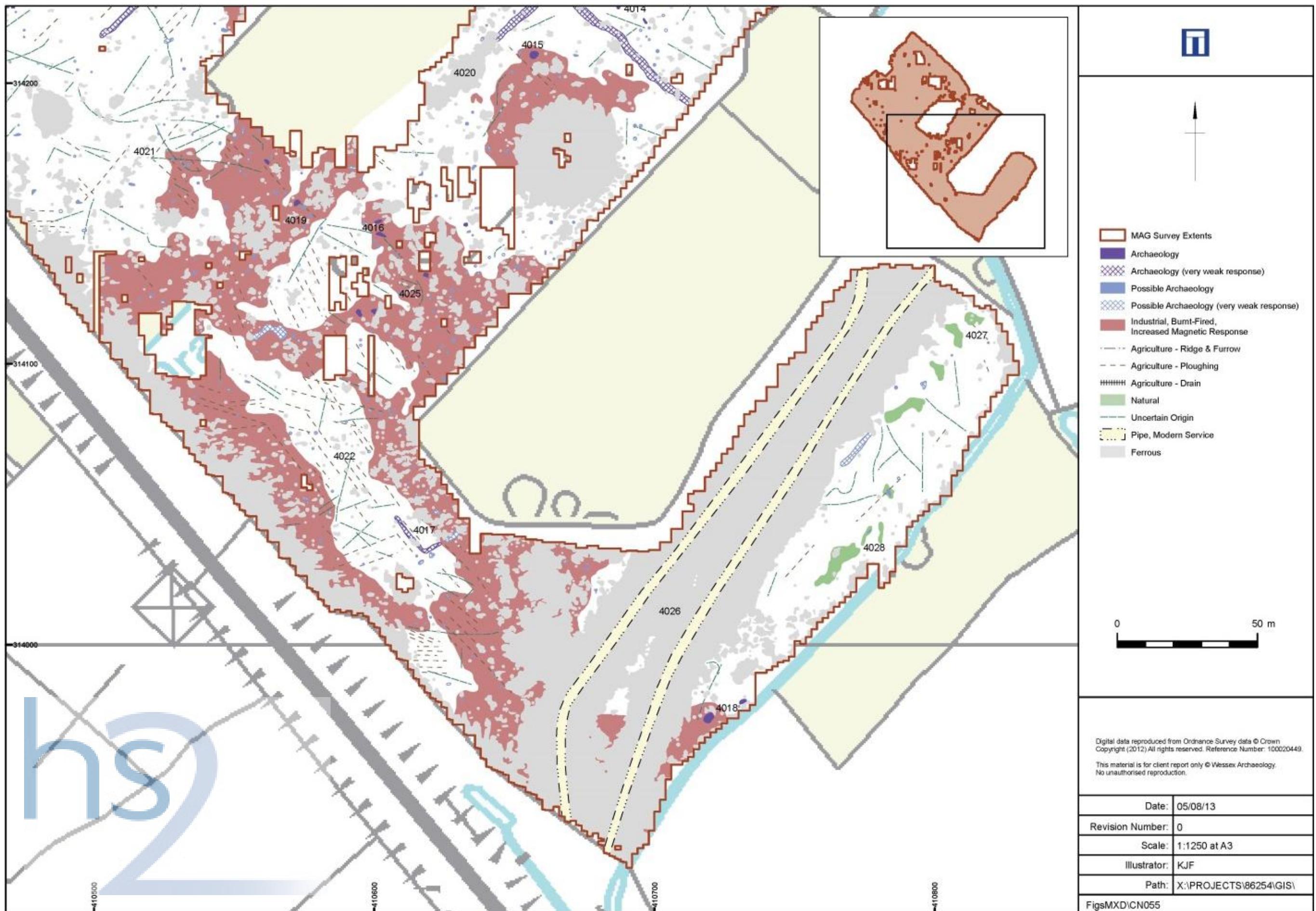
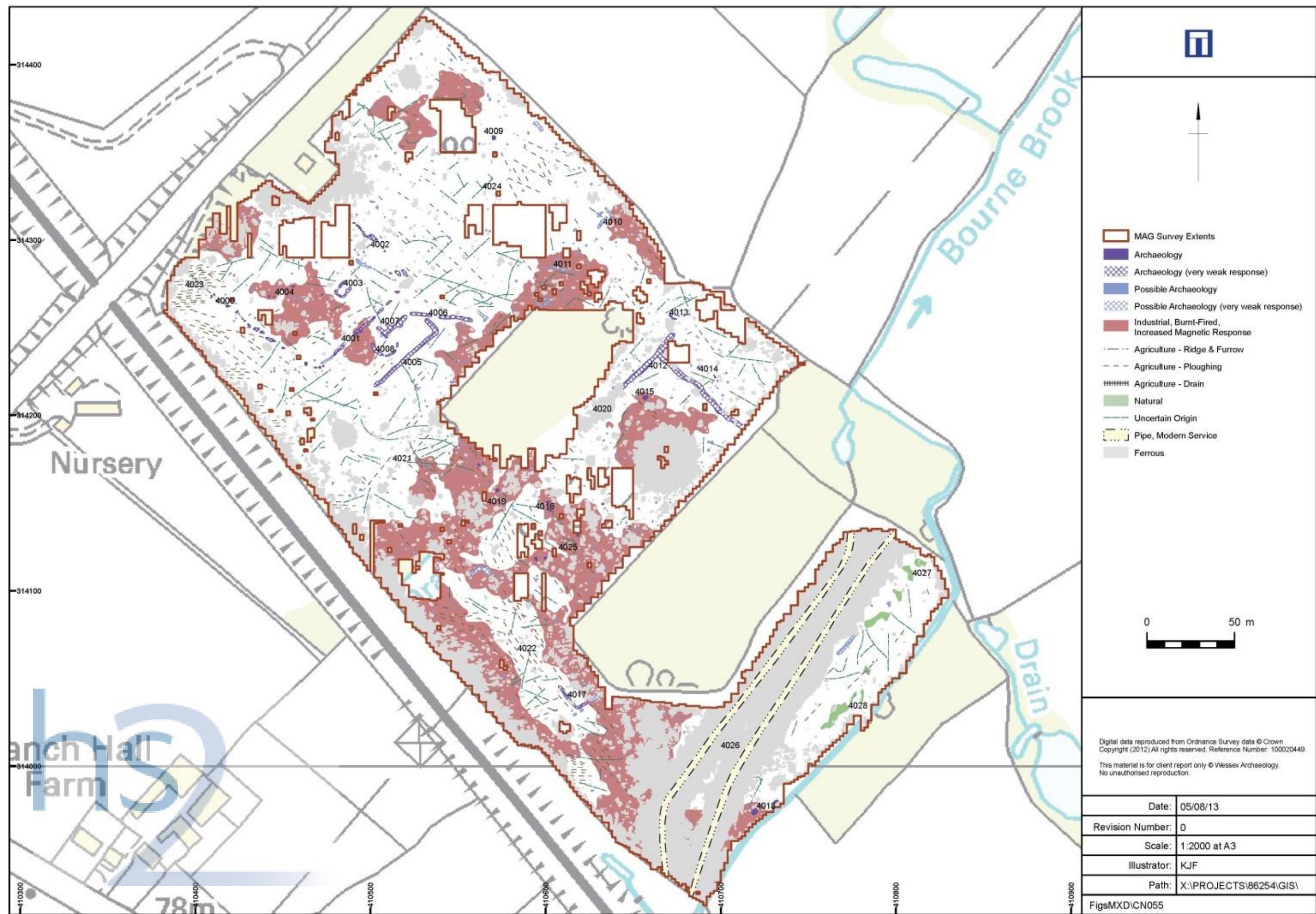


Figure 41: Interpretation overview



4.6 Appendix 1. Survey Equipment and Data Processing

Survey Methods and Equipment

- 4.6.1 The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.
- 4.6.2 The gradiometers have an effective resolution of 0.03nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.
- 4.6.3 Wessex Archaeology conducts detailed gradiometer surveys using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.
- 4.6.4 The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH 2008).
- 4.6.5 Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

- 4.6.6 The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.
- 4.6.7 As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.
- 4.6.8 Typical data and image processing steps may include:
- destripe – applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
 - destagger – shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;

- despoke – filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- deslope – this function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set; and
- multiply – the multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

4.6.9 Typical displays of the data used during processing and analysis:

- XY plot – presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies; and
- greyscale – presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

4.7 Appendix 2: Geophysical Interpretation

Interpretation Categories

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

4.7.1 Archaeology – used when there is a clear geophysical response and anthropogenic pattern.

4.7.2 Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

4.7.3 The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Industrial, Burnt-Fired, Increased magnetic response – used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential;
- Uncertain Origin – used for low amplitude or indistinct linear anomalies;
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin;
- Agricultural – used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars; and

- Natural – used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.
- 4.7.6 Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.